RECORD OF DECISION

MONSANTO CHEMICAL COMPANY
Superfund Site
Caribou County, Idaho

April 1997

US ENVIRONMENTAL PROTECTION AGENCY
Region 10
Office of Environmental Cleanup

Monsanto Record of Decision
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Declaration of the
RECORD OF DECISION
for the
Monsanto Chemical Company Superfund Site
Caribou County, Idaho

Statement of Basis and Purpose

This decision document presents the selected remedy for the Monsanto Chemical Company Site (the Site) in Caribou County near Soda Springs, Idaho, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the Site.

A letter indicating that the State of Idaho concurs with the selected remedy is attached.

Assessment of the Site

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This is intended to be the final remedy for this Site. Previous actions have already addressed the principal sources of contaminant releases at the Site. The selected remedy described in this document addresses the remaining threats posed by the Site.

The major components of the selected remedy by media are:

- GROUNDWATER: The selected remedy for groundwater is monitored natural attenuation with institutional controls to prevent use of contaminated groundwater for drinking purposes, until such time as cadmium, fluoride, selenium, nitrate and manganese concentrations in groundwater decline to below the primary Maximum Contaminant Levels (MCLs) or risk-based concentrations for those substances .

- SOILS: For contaminated soils outside the Monsanto Plant boundary line (the Plant), the selected remedy is an election by affected property owners for either: a) institutional controls, or b) excavation of contaminated soils, replacement with clean soil, and disposal of the contaminated soils within the Plant.

- SOURCE PILES, AIR, SURFACE WATER AND SEDIMENTS: No further action is necessary under CERCLA for source piles and materials within the Plant, nor for air, surface water, or Soda Creek sediments.

Except as expressly stated in CERCLA, the NCP, or this ROD, the ROD is not designed to address Monsanto's ongoing operations, or to preclude, or in any way affect, the need for the Plant's ongoing operations to comply with other environmental laws or regulations.

While not part of the selected remedy, the selected remedy assumes continued operation of the Plant by Monsanto in compliance with all Federal and State environmental requirements as well as the applicable closure requirements in the event that the Plant ceases operation. If air emissions exceed permitted levels, they could pose additional risks to human health or the environment or allow unacceptable levels of contaminants to migrate to surrounding soils at or near the Site which could require additional CERCLA action. The effect of ongoing and future air releases on surrounding soils, human health and the environment will be evaluated during five-year reviews.

Remedial alternatives were not developed for alternative future industrial or residential scenarios within the Plant and no remedy has been selected based on such scenarios because Monsanto is considered highly likely to continue to operate the Plant for the foreseeable future. Monsanto has just increased production and maintains it has the reserves to profitably operate the Plant for over 30 more years.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this Site. However, because the sources of contaminant releases have been controlled and treatment of the remaining threats at the Site was not found to be practicable, the selected remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in hazardous substances remaining on Site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Richard L. Miller, acting
Chuck Clarke
Regional Administrator
U.S. EPA Region 10

April 30, 1997
Date

Post-it® Fax Note 7671	Date 4-30	# of pages ▶ 1
To Tim Brincefield	From Rob Hanson	
Co./Dept.	Co. DEQ	
Phone #	Phone #	
Fax # 206 553-0124	Fax #	

IDAHO DEPARTMENT
OF HEALTH AND WELFARE

DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton, Boise, ID 83706-1255, (208) 373-0502

Philip E. Batt, Governor

April 29, 1997

Tim Brincefield - HW-113
US EPA Region 10
1200 Sixth Ave.
Seattle, WA. 98101

Subject: State of Idaho Concurrence on the Monsanto, Soda Springs, Record of Decision (ROD).

Dear Mr. Brincefield:

Thank you for providing the State of Idaho an opportunity to review and comment on the Monsanto, Soda Springs, Idaho Superfund Record of Decision. Staff from Idaho Division of Environmental Quality, Pocatello Regional Field Office, Central Office and the Attorney General's Office, have reviewed and provided comments on the document. Those comments have been addressed in the final ROD. We also believe EPA has appropriately addressed comments provided by the community and other affected parties.

Your consideration of our input in selecting the remedy for this site is appreciated. We concur with the remedy selected by EPA in the April 1997 Record of Decision for the Monsanto Chemical Company Superfund Site.

Sincerely,

Wallace N. Cory, P.E.
Idaho Division of Environmental Quality
Administrator

WNC:mp

cc: Mark Lowe, Pocatello Field Office Administrator
Dean Nygard, Remediation Bureau Chief
Rob Hanson, Superfund Program Manager
Steve Goddard, A.G.'s Office
Curt Fransen, A.G.'s Office
Gordon Brown, Pocatello Field Office Remediation Project Officer

DECISION SUMMARY
Monsanto Chemical Company Superfund Site
Caribou County, Idaho

1. SITE LOCATION AND DESCRIPTION

The Monsanto Chemical Company Superfund Site is located in Caribou County, Idaho, approximately one mile north of the City of Soda Springs (see Figure 1). CERCLA regulations define the term "site" as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." The Monsanto Site (the Site) includes an active elemental phosphorus plant operated by the Monsanto Company (the Plant) and those portions of the surrounding property which have been contaminated by Plant operations or are necessary for the conduct of the selected remedy. The term "Plant" is used in this ROD to refer to those portions of the Site which are owned by Monsanto and used for their elemental phosphorus manufacturing operations.

The Plant occupies approximately 540 acres in a tributary valley to the Bear River; the entire Site, including the Plant, includes about 800 acres. Land use in the vicinity of the Plant is a primarily agricultural and industrial. The closest surface water body is Soda Creek, located approximately 2,000 feet west of the Plant.

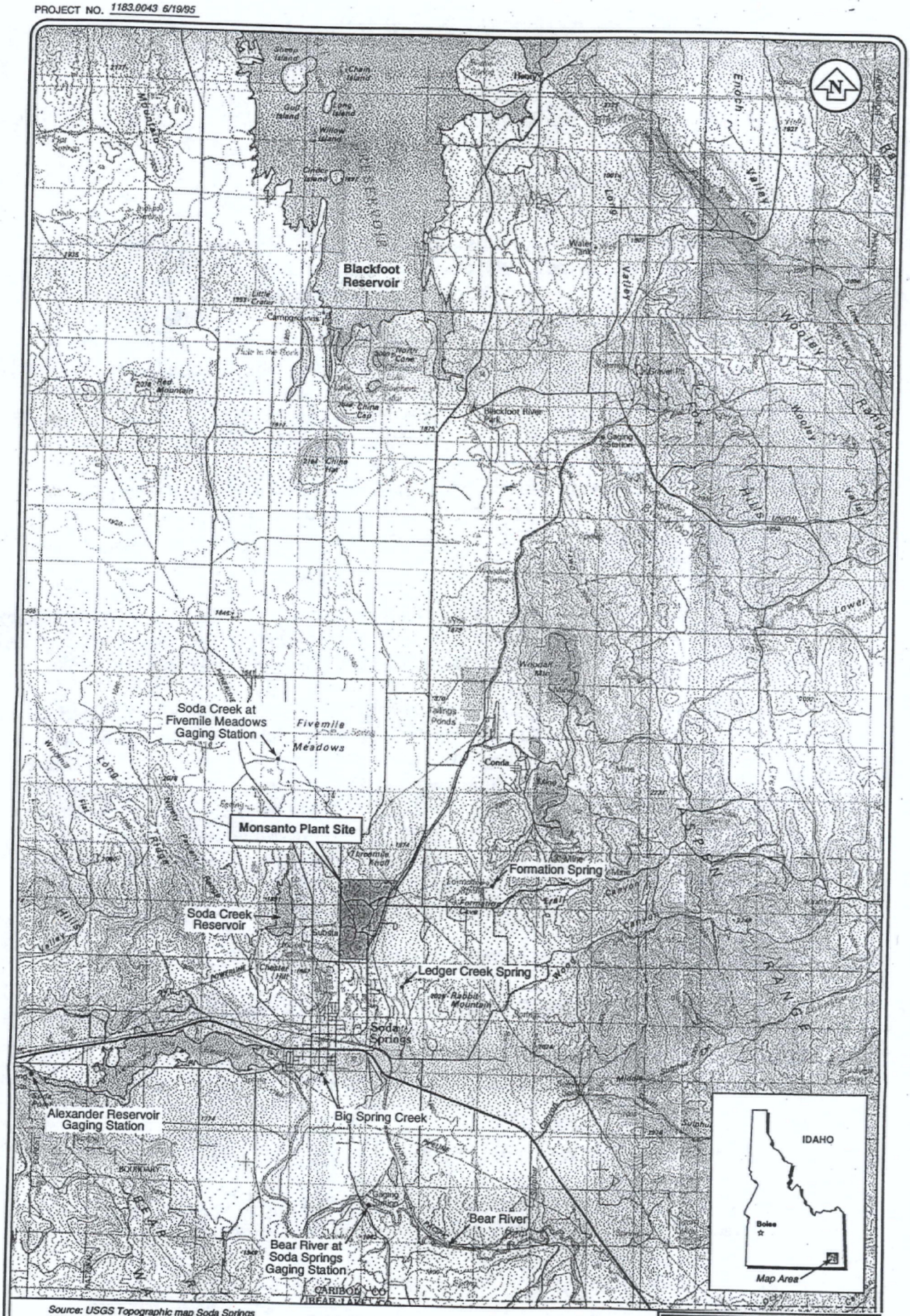
Population density in the area is sparse. Within 1 mile of the Site there are about 30 residents, and within 2 miles there are about 1,400 residents. About 3,000 residents, which includes the most of the population of the City of Soda Springs (the City), live within 3 miles of the Site.

Most of the community residents' water is supplied from the City. This water is obtained from Formation Springs located to the northeast of the City and the Plant, and from Ledge Creek Springs to the southeast. Both City springs are in different hydrogeological systems from, and are therefore unaffected by, the Site. Twenty-two domestic water supply wells are registered within 3 miles of the Site (most of them upgradient), as well as seven irrigation wells. Hooper Springs, located downgradient but showing no evidence of contamination, is occasionally used by tourists and residents for drinking. The only domestic well known to have been affected by groundwater contamination is at a home located 0.2 miles south of the Plant. This home was connected to City water by Monsanto after selenium contamination was found in the well.

A number of other industrial sites are located in the valley. These include:

- Kerr-McGee Chemical Corporation (production of vanadium compounds), across Highway 34 from the Monsanto Plant;
- City Industrial Park (various), adjacent to the Monsanto Plant to the Southeast;
- Evergreen Resources (fertilizer products) and Soda Springs Phosphate Industries (fertilizer products) 1,000 to 2,000 feet southeast of the Plant; and
- Nu-West Industries (phosphoric acid production and fertilizer products), four miles north of the Monsanto Plant (not shown on Figure 1).

PROJECT NO. 1183.0043 6/19/95



Source: USGS Topographic map Soda Springs Idaho—Wyoming 1:100 000 metric (1982); and Monsanto, Phase II RI Report (Golder, 1995)

MONTGOMERY WATSON

Scale in Kilometers
0 1 2 3 4 5
Scale in Miles
0 1 2 3 4

Monsanto Site
LOCATION MAP
Figure 1

Climate

The climate around Soda Springs is semi-arid, with hot summers and cold winters, characterized by relatively low precipitation (RI report cites averages of 16 and 19 inches per year), and high evapotranspiration (averages range from 1 to 8 inches per month).

Surface Hydrology

The major river in the vicinity of the Monsanto Plant is the Bear River, located approximately two miles to the south and southwest of the Monsanto Plant. Regional manmade surface waters include Alexander Reservoir and Blackfoot Reservoir. Natural local surface-water features in the Monsanto Plant vicinity include Soda Creek, Ledger Creek, Big Spring Creek, two wetland areas, and numerous springs and spring-fed ponds. Local manmade surface-water features include the ponds within the Monsanto and Kerr-McGee Plants and Soda Creek Reservoir to the west.

Soda Creek, which is a tributary of the Bear River, forms the main surface water drainage for the Plant and the surrounding area. Soda Creek originates at Fivemile Meadows and flows south (about 2,000 feet west of the Plant) to its discharge into Alexander Reservoir. Soda Creek is used for power generation and irrigation. There are three powerhouses located above Alexander Reservoir. Under a National Pollutant Discharge Elimination System (NPDES) Permit (which requires measurement of pH and temperature), Monsanto discharges non-contact cooling water into Soda Creek via an underground pipeline. An irrigation diversion dam is located just downstream of the Monsanto effluent outfall, and flow is diverted from the creek for parts of the year.

Geology

The geology (and resultant hydrogeology) in the vicinity of the Site is quite complex. Regionally, the Plant is located near the southern end of the Blackfoot Lava Field that has filled a valley bordered by the Chesterfield Range and the Soda Hills on the west, and by the Aspen Range on the east. Locally, the Plant is underlain by a thin veneer of soils that overlie basalt flows of the Blackfoot Lava Field. Five basalt flows, separated by sedimentary interbeds or weathered basalt zones, are present beneath the Plant. The basalt flows vary in thickness from less than 10 feet to 80 feet. The sedimentary units and weathered basalt zones range from 1 to 23 feet thick. The basalt flows overlie the Salt Lake Formation.

Fault displacement has apparently interrupted lateral groundwater flow and created springs in the vicinity of the Plant. A series of north-northwest trending faults, typically 1,000 to 1,500 feet wide and up to 2.5 to 3 miles long, extend from the southeast of the Plant north to the Blackfoot Reservoir. A prominent fault enters the Plant near the northwest corner and appears to die out just west of the southeast corner of the Plant. A subsidiary fault parallels this fault approximately 1,500 feet to the southwest.

Several normal faults exist east of the Plant that appear to act as a hydraulic barrier, such that groundwater west of the Finch Spring fault apparently does not flow into the Ledger Creek Springs area.

Soils

The soils around the Plant are largely classified as clayey silt with some sand and a trace of gravel. Soil depth in the area typically ranges from 3 to 23 feet. There was no appreciable difference between samples collected from the 0-to-l-inch depth interval and those collected from the 0-to-6-inch depth interval. Soils within the Plant are covered by facilities and materials and cannot be correlated with the surrounding soils.

Hydrogeology

There are three dominant groundwater systems in the region of the Monsanto Plant:

> The **Mead Thrust Aquifer System** receives recharge by precipitation over the mountains to the east of the Plant. The direction of groundwater movement in this system is westward. Groundwater discharge occurs through several springs along faults at the eastern margin of the Blackfoot Lava Field, including Formation Spring.
>
> The **Chesterfield Range Aquifer System** receives recharge from the Chesterfield Range to the west of the Plant. Groundwater from this system discharges along the western margin of the Blackfoot Lava Field via deep, normal faults.
>
> The **Shallow Groundwater System** consists of water that comes into contact with the upper basalts of the Blackfoot Lava Field. The direction of groundwater movement in this system is typically to the southwest but can be affected by faults and pumping of production wells (for process water)at both Monsanto and Kerr-McGee. Groundwater discharges from this system into Soda Creek, Alexander Reservoir, and the Bear River.

Groundwater from these systems flows through four local hydrogeologic zones located beneath the Plant, described in greater detail in the RI. The Surficial Deposit Zone (SDZ) is only present in the northeast portion of the Plant at a thickness of about 10 to 40 feet. The Salt Lake Zone (SLZ) is located in the north central and northeast portions of the Plant, and may also be present beneath the Lower Basalt Zone. The Upper Basalt Zone (UBZ) is an aquifer underlying the Plant at depths ranging from about 20 feet below ground surface (bgs) in the northeast corner of the Plant, to about 100 feet bgs in the center of the Plant. The Lower Basalt Zone (LBZ) underlies the UBZ and the Plant at depths of at least 250 feet bgs. Groundwater flow in the UBZ and the LBZ is influenced by faulting and by pumping of the Plant production wells.

The estimated hydraulic conductivity for the basalts below the Plant ranges from 0.04 to 676 ft/d. Hydraulic conductivity values appear to decrease with depth, and vary between interflow zones. Several multiple well aquifer tests were conducted to characterize the aquifers below the Plant. On of the key findings of those tests was that the Monsanto and Subsidiary Faults serve as barriers to groundwater flow for their length beneath the Plant, thus preventing hydraulic communication between some of the different groundwater regions.

Groundwater in the vicinity of the Plant can be characterized as either fresh or sodic, with sodic water defined by a bicarbonate alkalinity exceeding 700 mg/L. Fresh water occurs predominantly in the UBZ in the Plant vicinity. Sodic water occurs in the LBZ on the west side

of the Plant, and fresh water occurs in the LBZ on the east.

2. SITE HISTORY AND ENFORCEMENT ACTION

The Monsanto Soda Springs Plant processes locally mined phosphate ore to produce elemental phosphorus. In 1952, Monsanto purchased the Plant site, built the Plant, and started operations. The fenced Plant consists of more than a dozen administrative and processing buildings plus ore piles, slag piles, by-product materials, surface impoundments, and a solid waste landfill.

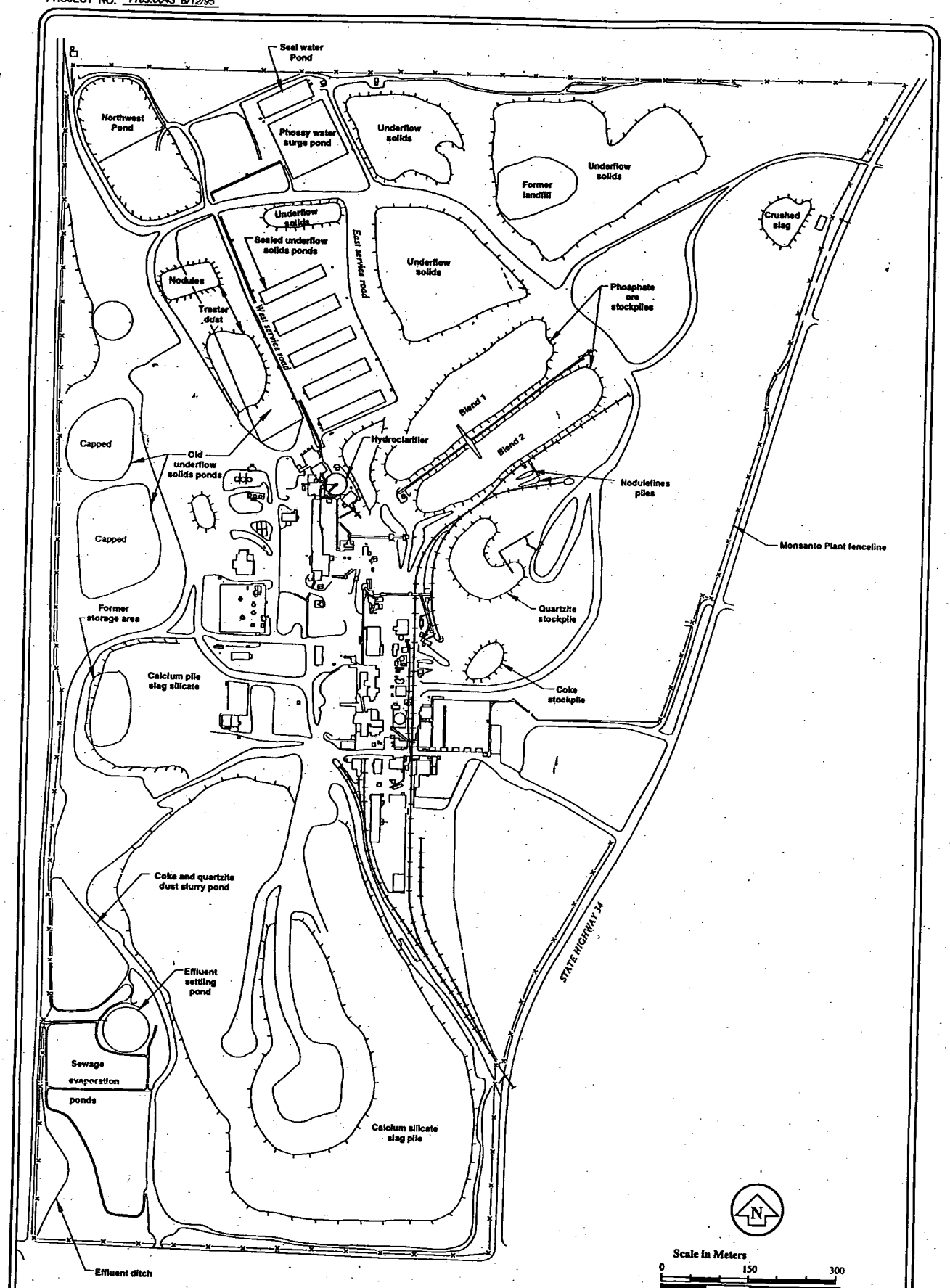
The Plant is currently staffed with about 400 employees. Two of three on-site production wells previously provided potable water for employee consumption. In December, 1989, a new well, upgradient from all Plant operations was installed to provide potable water for employee use separate from process water.

Approximately 1 million tons of phosphate ore are processed through the Plant each year. The ore is first "nodulized" in a rotary oxidation kiln where organic contaminants are released and burned. Some fluorides (about 0.7 pounds per hour) are released from the process stacks in accordance with the Clean Air Act permit for this process. Carbon monoxide generated in the final electric arc furnaces is recycled as a supplemental fuel to provide heat for the nodulizing process.

Nodulized ore to be reduced to elemental phosphorus is fed with coke and silica into three electric arc furnaces. The process gases contain phosphorus, silicon tetrafluoride, and carbon monoxide. The phosphorus is condensed out for recovery, and the particulates are removed by electrostatic precipitators. The carbon monoxide is cycled back to the nodulizer as a fuel, and the particulate from the nodulizer operation is removed by high energy venturi scrubbers. Molten slag from the process is periodically tapped from the furnace. The heavy fraction of the slag consisting primarily of metals (iron, vanadium, and others) is tapped separately and sold as a material for extraction of the vanadium.

"Underflow solids" (UFS) are fine grained particulate matter removed from rotary-kiln exhaust gas in a wet slurry, which is settled and dewatered in the hydroclarifier. The resulting coarse-to-fine solids are stockpiled in the northeast corner of the plant and recycled slowly in the process due to its low-grade phosphate ore value.

PROJECT NO. 1183.0043 6/12/95



SOURCE: Monsanto, Phase II RI Report (Golder, 1995).

MONTGOMERY WATSON

Monsanto Site
PLANT LAYOUT
Figure 2

Previous Studies

Monsanto initiated a number of environmental studies to characterize potential impacts from its operations. In 1980, the slag was analyzed for Extraction Procedure toxicity parameters established by the Environmental Protection Agency (EPA) and found not to exceed any of the standards. In 1984, Golder Associates was commissioned to evaluate groundwater and surface water impacts resulting from current and past activity. Thirty-one new monitoring wells were installed to supplement seven existing wells (additional wells have been added subsequently). This investigation showed groundwater under the Site to be contaminated with fluoride, cadmium, selenium, vanadium, and other inorganic species of less concern. The sources of the contamination were hypothesized to be the underflow solids pond, the northwest pond, and the hydroclarifier. The underflow solids pond and northwest pond were subsequently taken out of service (see below). The hydroclarifier has been rebuilt to allow complete inspection for leakage, none of which has been found.

A separate plume showing contamination with chloride, sulfate, and vanadium exists in the southeast portion of the Site. This plume originates east of the Monsanto Site.

Listing on the National Priorities List

In 1987, Ecology and Environment, Inc. (E.& E.), an EPA contractor, performed further sampling as part of a site inspection. Contamination was found in monitoring and production wells. One of the contaminated production wells was being used for drinking water by Plant employees at the time. Subsequent to that inspection, the Site was evaluated for inclusion on the National Priorities List (NPL) of Superfund sites requiring investigation and, if necessary, cleanup of uncontrolled releases of hazardous substances to the environment.

EPA proposed the Monsanto Site to the NPL in May, 1989; the Site was made final on the NPL on August 30, 1990 (55 Fed. Reg. 35502). EPA took this action pursuant to its authority under Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). EPA and Monsanto negotiated an Administrative Order on Consent (AOC), pursuant to which Monsanto agreed to perform a Remedial Investigation/Feasibility Study (RI/FS) for the Soda Springs Site. The AOC was issued by EPA on March 19, 1991.

Remedial Measures to Date

Since 1983, investigations and actions by Monsanto in conjunction with EPA's activities pursuant to CERCLA have resulted in significant environmental improvements and reduced emissions at the Plant. Some of these improvements were made independently by Monsanto, and others were done to comply with state and/or federal requirements. These actions have addressed many of the known and suspected sources of contamination investigated during the RI/FS. The measures included the following:

- In August, 1985 the hydroclarifier, which was suspected as potentially affecting groundwater, was replaced with a unit that includes a synthetic liner, a leachate

collection system, and a monitoring well network.

- In 1986, an old coke and quartzite dryer and wet scrubber was replaced with a more efficient dryer and dust collector, resulting in air emission reductions of over 95 percent.

- In 1986, four underground fuel storage tanks were replaced with aboveground tanks with concrete sumps. These underground tanks were removed to comply with new regulations. There was no indication that leaking had occurred.

- In September, 1987, four parallel high energy venturi scrubbers, separators, fans, and stacks were installed to provide additional scrubbing of kiln exhaust. The parallel arrangement of equipment effectively reduces upset/breakdown emissions that would occur if only one or two fans existed. This project resulted in a reduction of particulate emissions of about 95 percent and contributes to a cumulative cleaning efficiency of 99.9 percent.

- In 1987, four wells (TW-3, TW-4, TW-5, and TW-6), which were discovered to be creating hydraulic communication between upper and lower aquifers due to poor construction, were abandoned in accordance with regulatory guidelines.

- In 1983, the old underflow solids ponds, suspected as sources of groundwater contamination, were taken out of service. Much of the solids were subsequently excavated and recycled. In 1988, the upper layer of contaminated soil was removed, and the depression was backfilled with material excavated from the northwest pond (see below) and clean material. The ponds were then filled with molten slag and sealed with a bentonite cap to isolate the remaining underflow solids from infiltration and prevent further migration of contaminants. Solids that remained in the pond are below the cap, but above the water table.

- In 1988, the northwest pond, also a suspected groundwater contamination source, was closed and excavated. Discolored soils were removed and deposited in the old underflow solids ponds. The base of the pond was sealed with bentonite. The area is currently permitted by the Idaho Department of Environmental Quality to receive Plant sanitary solid waste and is being operated as a lined general waste landfill.

- In 1988, a new Plant drinking water well (PW-4) was installed upgradient of known and suspected source areas to prevent degradation of the potable water supply. A new independent potable water distribution system was installed with the new well, thus preventing cross-connection of potable and raw process water at the Plant.

- Between 1985 and 1989, several wells were installed around the hydroclarifier and used as recovery wells to intercept contaminated groundwater. The groundwater was pumped into the new hydroclarifier. Three wells were pumped intermittently at a rate of approximately 12 gallons per minute (gpm) per well from 1985 to 1989. The Plant stopped pumping these wells in the spring of 1989 based on potential listing of the Plant for the NPL and has not resumed since then.

- Since 1990, fugitive emissions from the baghouse dust disposal pile have been reduced through improved handling procedures and placing crushed slag on the surface of unused portions of the pile. Additional projects have significantly reduced fugitive air emissions from the conveyance of slag from the furnace.

- During 1992, emission controls were implemented in the nodule reclaim area. These controls included a stationary stacking tube and dust collectors at material transfer points to reduce fugitive dust emissions.

- In 1993, Plant sewage evaporation ponds were taken out of service and the Plant was connected to the City wastewater collection system. The ponds were closed in 1995.

- In 1995, pilot-scale demonstration projects were initiated to evaluate the effectiveness of several types of dust suppressants for on-Plant stockpiles. The most successful was application of a concrete/synthetc slurry mixture, which dries to a crusty surface, effectively preventing fugitive emissions from piles on which it is applied. As of this time (Spring 1997), Monsanto reports that the Plant has continued to use this method to control emissions from piles which are not being actively used. Piles which are still being used are not currently covered, although efforts are made to minimize fugitives. Monsanto maintains that it is taking all feasible measues to minimize fugitive emissions from the Plant.

Regulatory Status

A review of the Plant's regulatory status as of August, 1996, shows that the Plant is in compliance with the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA), and the National Pollutant Discharge Elimination System (NPDES). In addition, the Monsanto Plant has received awards from the Occupational Safety and Health Administration (OSHA) because of its implementation of worker safety programs, compliance with OSHA regulations, and worker safety record.

Monsanto has complied with the requirements of the RI/FS AOC.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

At the Monsanto Site, EPA has met all requirements of CERCLA Section 117 and the NCP for public participation at NPL sites. Nomination of the Site to the NPL followed extended public comment. Subsequent to listing the Site on the NPL, EPA conducted community interviews to identify community concerns and developed a **Community Relations Plan** to guide future public involvement in the RI/FS. The Site Community Relations Plan was published in 1990, and will be updated after ROD signature and before the start of remedial design.

An **Information Repository** was established and has been maintained at the Soda Springs Public Library. An **Administrative Record** and Site File, which are available for review at the Information Repository in Soda Springs and the EPA Regional Office in Seattle, were established and have been maintained since the beginning of this project.

Numerous **fact sheets** were produced during the RI/FS to keep members of the community informed and to solicit their input on the project. The following are the dates for the more significant fact sheets and the topics they addressed:

Dec. 1991	Introduction to the Superfund Process;
May 8, 1992	Monsanto to Conduct Additional Testing This Spring and Summer;
Mar 15, 1994	Investigation Nearly Complete; Risk assessment being prepared;
July 27, 1994	Congressional Update - Superfund Studies Underway;
June 29,1994	Postcard/advertisement for July 13, 1994, Open House describing the progress of the Remedial Investigation;
Oct. 3, 1994	EPA Responds to Community Questions; Risk Assessment Report Delayed for More Work;
Jan 27, 1995	Risk Assessment Results;
June 2, 1995	Objectives for Clean Up/ Recap of Remedial Investigation and Risk Assessment Work;
July 29, 1996	Proposed Plan and Invitation to comment on the Plan.

In addition, several **public meetings** were held to inform community members and solicit their input on the project. EPA, with help from the Idaho Division of Environmental Quality (DEQ) of the Idaho Department of Health and Welfare (IDHW), planned and publicized these meetings. Monsanto also participated by presenting the results of their studies and answering questions.

- One such meeting was held on July 13, 1994, at which the results of the RI and the plans for upcoming risk assessment and FS work were presented.
- Another such meeting was held June 20, 1995, at which the results of the risk assessment and preliminary FS efforts were presented.

Approximately 25-30 people (including Monsanto Chemical Company and government representatives) attended each meeting. Before each meeting the Agencies discussed the meeting agendas with the Mayor of Soda Springs and Monsanto representatives, and after each meeting the Agencies reviewed the results of the meetings with the Mayor to ensure that community concerns were clearly understood.

In accordance with CERCLA requirements, once the RI/FS was complete EPA issued a **Proposed Plan** for a 30-day **public comment period**. The Proposed Plan (Plan) provided information on the alternatives considered and identified the preferred remedial alternative. The start of the comment period was announced in a **Public Notice** placed in the Caribou County Sun, in a fact sheet, and in the Plan, which was sent to the entire mailing list maintained by EPA for the Site on July 29, 1996. Both the Caribou County Sun and the Idaho Statesman published articles describing the Plan and announcing the public comment period. Owners of property adjacent to the Monsanto Plant were sent the Plan with a cover letter which pointed out that they or their property could be affected by the Plan, and were urged to review the Plan and to provide comments.

On August 13, 1996, EPA held a Public Meeting to describe the Plan and take formal public comments. The meeting was transcribed by a court reporter and all comments received are addressed in the Responsiveness Summary portion of this ROD.

On August 21, 1996, EPA received a request for a 30-day extension to the public comment period from the Mayor of Soda Springs, in order to give the Mayor, local officials and residents more time to review the Plan and provide comments. In response, EPA extended the comment period by 30 days, until September 30, 1996. All comments received at the public meeting and through the mail during the 60-day public comment period were considered in making this decision and have been summarized and addressed in the Responsiveness Summary.

4. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

The selected remedial actions are intended to be the final remedy for this Site.

The remaining threats to human health and the environment posed by the Site are from potential human exposure to groundwater contamination and contaminated soils. The previously uncontrolled *sources* of contamination and fugitive air emissions which led to listing have been addressed by various remedial, compliance, and worker health and safety measures implemented since listing. The selected remedy addresses the residual contamination in soils surrounding the Plant and the underlying groundwater.

The Monsanto Plant is an operating facility. Except as stated expressly in CERCLA, in the NCP, or in this ROD, this ROD is not designed the address the Plant's ongoing operations or preclude or in any way affect the need for Monsanto's ongoing operations to comply with other environmental laws or regulations. The selected remedy assumes continued operation of the Plant by Monsanto in compliance with all Federal and State environmental requirements as well as the applicable closure requirements in the event the Plant ceases operation.

The Plant is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation under the Clean Air Act and State Air permits to Construct and Operate pursuant to IDAPA 16.01.1012 (Rules and Regulations for the Control of Air Pollution in Idaho). Under these regulations, Monsanto is required to control fugitive dust emissions and is subject to inspections. Compliance with these requirements provides adequate protection of public health and the environment. If Monsanto fails to remain in compliance, such failure could lead to

unacceptable risks and the need to re-evaluate the protectiveness of this CERCLA response action. This ROD requires No Further Action for air and source piles under the assumption that existing controls, including dust suppression of the underflow solids and treater dust piles will be maintained, and efforts will be made to eliminate the piles in the future. If during 5-year reviews concentrations in soils surrounding the Plant are found to increase or dust emissions have exceeded permitted levels and pose significant risks to public health or the environment, additional action will be considered.

The Resource Conservation and Recovery Act (RCRA) lists solid wastes that are regulated as hazardous wastes in 40 C.F.R 261.3. Solid wastes generated from the extraction, beneficiation and certain processing of ores are excluded from this listing (40 C.F.R 261.4). Monsanto has evaluated process waste streams and activities throughout the plant for hazardous waste characterization. Appropriate measures have been taken to comply with RCRA requirements regarding non-exempt waste streams that were characterized as hazardous. A RCRA permit for the Plant is not required based on current law. The Plant operates as a small quantity generator of hazardous wastes (40 C.F.R 262.34) for generation of items such as spent safety-clean solvents, fluorescent light bulbs, aerosol cans, and nicad batteries.

Former off-Site uses of slag were not evaluated in this RI/FS. Such uses and associated potential risks are being addressed under Administrative Orders on Consent issued by EPA, most recently in 1996, pursuant to Section 7003 of RCRA, to Monsanto and the FMC Corporation (a producer of similar slag).

Remedial alternatives were not developed for alternative future industrial scenarios within the Plant and no remedy has been selected based on such scenarios because the Plant is expected to operate for the foreseeable future. Monsanto has just increased production and has indicated it has the reserves to profitably operate the Plant for over 30 more years.

5. SUMMARY OF SITE CHARACTERISTICS

Between March 1991 and November 1995, a Remedial Investigation was performed to determine the nature and extent of contamination at the Site. Soil, sediment, surface water, and groundwater samples were collected, and air emissions were evaluated through modeling . Air, surface water, soils surrounding the Plant, source piles, and groundwater were identified as media of potential concern at the Site. Details of the investigations and the nature and extent of contamination present at the Site are provided in the RI report.

Risk-Based Concentrations (RBCs) were initially developed for screening purposes based on a conservative target carcinogenic risk of 1E-07, and a target hazard quotient (HQ) of 0.1 for all media, using toxicity values and EPA default exposure assumptions for a residential scenario. Similarly, RBCs were developed for on-Plant source materials using industrial scenario default parameters. RBCs for radionuclides were calculated using the residential and industrial exposure default parameters from Risk Assessment Guidance, Part B (U.S. EPA 1991), as modified in August, 1992, by EPA Region 10.

In summary, after screening using conservative human health and ecological screening values, the contaminants of potential concern in soils and on-Plant source piles include radionuclides (radium-226, lead-210, and uranium-238) and chemicals (arsenic, beryllium, selenium and zinc). The groundwater contaminants of potential concern include those substances detected at concentrations above primary MCLs, i.e. cadmium, fluoride, nitrate, and selenium, and manganese, which is present above a secondary MCL. After this initial screening for preliminary contaminants of concern, the risk assessment (and the rest of this ROD) used RBCs equivalent to carcinogenic risks of $1x10^{-6}$ and/or a HQ of 1.0 to identify contaminants of concern. More details follow.

Nature and Extent of Constituent Releases

The nature and extent of constituent releases at the Monsanto Plant are summarized below by the environmental media characterized during Phase I and II RI field activities. Figure 3 shows the conceptual Site model developed in the RI.

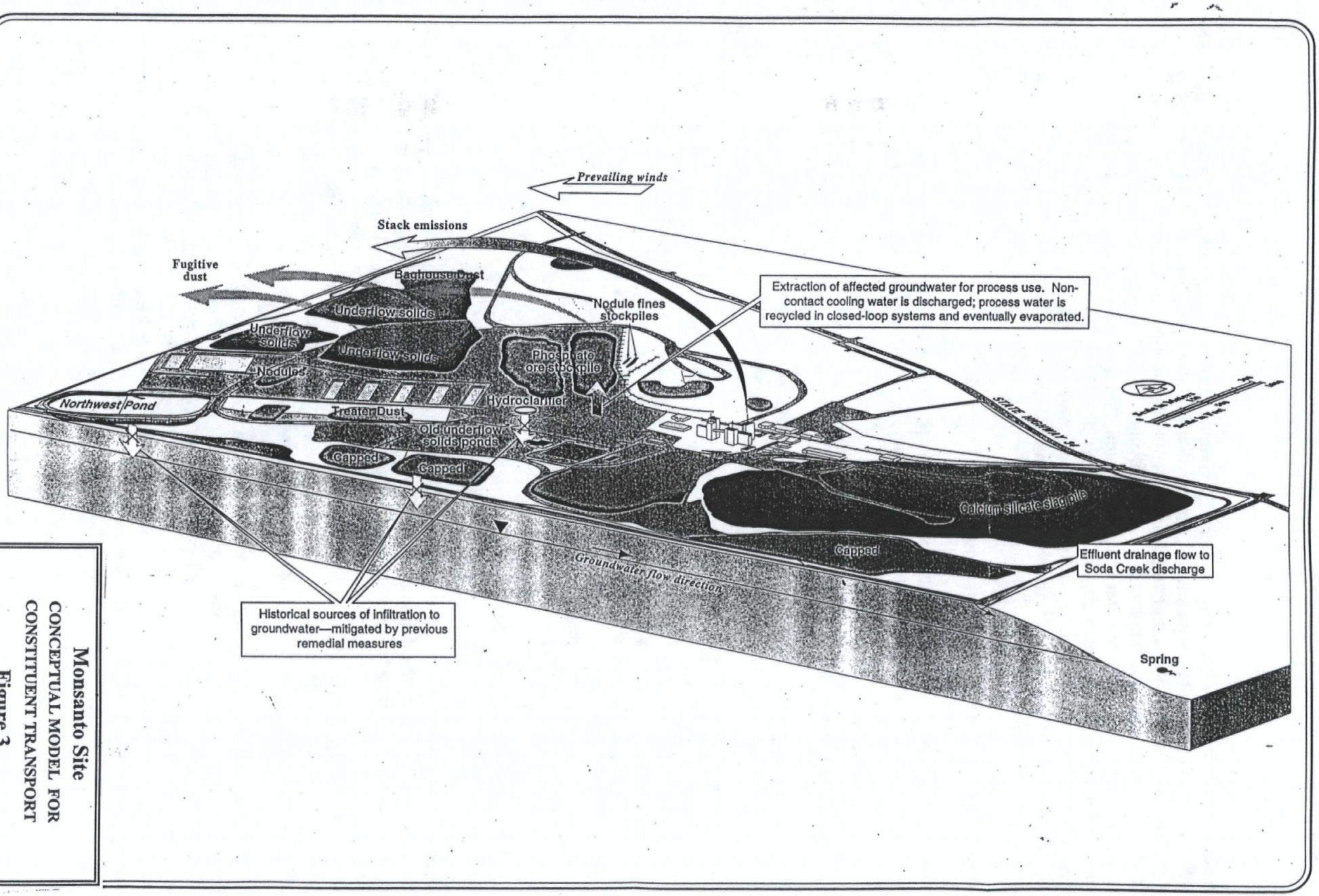
Sources of Constituent Release

Numerous media were evaluated in detail with respect to their potential to be sources of environmental contamination at the Monsanto Plant. Potential sources included:

Ore and coke stockpiles;
Nodule stockpiles;
Baghouse dust;
Calcium silicate slag piles;
Coke and quartzite dust slurry pond;
Nodule fines piles;
Non-contact cooling water effluent;
Treater dust stockpiles;
Underflow solids piles;
Unpaved haul roads; and
Process stacks air emissions.

Fugitive dust emission is the principal mechanism of hazardous constituent release to the environment surrounding the Monsanto Plant for ore and coke stockpiles, nodule stockpiles, baghouse dust, the coke and quartzite dust slurry pond, nodule fines piles, treater dust stockpiles, underflow solids piles, and unpaved haul roads. Gaseous emission is the principal release mechanism for both the process stacks and during calcium silicate slag pouring. Decay of naturally-occurring radionuclides in the ore stockpiles, underflow solids piles, and the calcium silicate slag pile is also a potential release mechanism.

Three primary groundwater contaminant plumes have been defined below the Monsanto Plant. These plumes occur below the three main sources of groundwater contamination found in the RI: the Northwest Pond, the hydroclarifier, and the old underflow solids ponds. The RI concluded that Monsanto actions to eliminate these sources of constituent releases to groundwater and cap them to reduce or eliminate infiltration have been successful in controlling all known releases and have resulted in measurable, declining concentrations of concern in



Monsanto Site
CONCEPTUAL MODEL FOR CONSTITUENT TRANSPORT
Figure 3

groundwater. While the sources appear to have been adequately controlled, residual contaminants bound up in the pore space of the vadose zone and aquifer appear to likely to continue to release declining levels of contaminants for some period of time. Modeling done to support the RI/FS predicted that all contaminants should achieve background levels within 5 to 30 years, depending on the contaminant and its rate of retardation in groundwater.

Air Quality

The Monsanto Plant has attained and continues to meet emission requirements for sulphur dioxide and fluoride, which are monitored by Monsanto and reviewed by the State of Idaho under the Clean Air Act. Radionuclide emissions from the stacks are regulated under the NESHAP and are in compliance with those standards, which are based on emissions achieved by the control technology at this Plant.

A detailed inventory of source emissions was conducted to provide input for the Phase II RI air dispersion modeling assessment. Air dispersion modeling for the Phase II RI was used to calculate annual average ambient air concentrations and deposition rates for total suspended particulate matter (TSP), inhalable particulates (PM10), and trace contaminants in TSP, including these contaminants of potential concern: arsenic, beryllium, cadmium, manganese, silver, vanadium, zinc, molybdenum, fluoride, lead-210, polonium-210, radium-226, thorium-230, uranium-234, and uranium-238.

The primary sources of trace constituent emissions were identified from modeling as the kiln venturi scrubbers, wind erosion of the underflow solids (UFS) stockpile, slag handling operations, nodule handling operations, taphole fume collectors, nodule crushing and screening scrubber, and kiln cooler spray tower.

The dispersion modeling analysis indicates that air emissions from the Plant are generally transported along a North North East-South South West axis in accordance with the prevailing wind directions.

The primary sources that individually may contribute $\geq$ 10% to the total annual average deposition rates of trace contaminants are wind erosion of the UFS stockpile, stack emissions from the nodule crushing/screening scrubber, wind erosion of the ore stockpile, wind erosion of the treater dust stockpile, and wind erosion of the slag stockpile.

Surface-Water and Sediment Quality. Soda Creek is the only natural stream which is nearby and potentially affected by the Site. The upper portions of Soda Creek do not support a fisheries resource due to naturally-occurring carbon dioxide concentrations in the water. The lower reach of Soda Creek, just above its confluence with the Alexander Reservoir, provides a marginal trout fishery for local residents. Fish in the Alexander Reservoir and Bear River include rainbow and cutthroat trout whitefish, yellow perch, dace, and shiners.

Surface water from Soda Creek and the irrigation canal, sediments in Soda Creek and the Alexander reservoir, and Monsanto Plant effluent were sampled and analyzed. Statistical analyses were performed on the water and sediment data to determine which downstream parameters are elevated with respect to upstream concentrations. Each elevated constituent

was subjected to a preliminary risk-based screening to determine which are considered contaminants of potential concern.

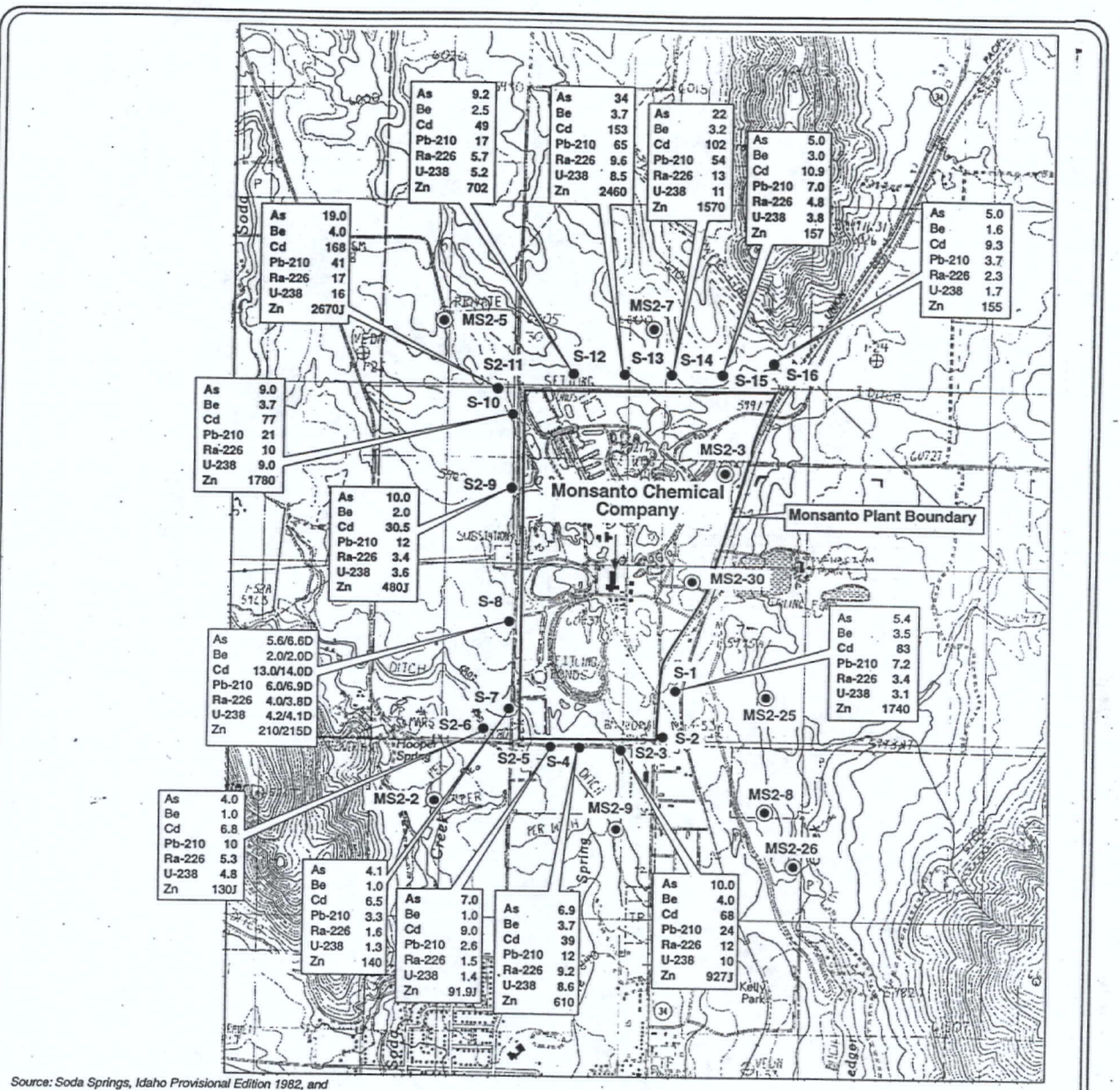
Surface Water. Except for nitrate, none of the elevated contaminants found in Soda Creek downstream of the effluent discharge exceeded preliminary human health or ecological risk-based screening criteria. Nitrate exceeded the risk-based screening value, one-tenth of the hazard quotient, based on ingestion of surface water by infants. This is considered an unlikely exposure scenario for Soda Creek due to the high sodic content. In addition, the nitrate concentration is less than the Maximum Contaminant Level (MCL). Therefore nitrate was eliminated from further consideration and no contaminants of potential concern were identified for surface water.

Sediments. Sediments collected from Soda Creek downstream of the effluent outfall in the RI were found to contain elevated levels of arsenic, cadmium, copper, nickel, selenium, silver, vanadium, and polonium-210. As a result, the Ecological risk assessment initially concluded that action might be warranted, and a decision was made to do an additional sediment investigation, including toxicity testing. Subsequently, additional samples were collected and toxicity testing was conducted on sediments collected upstream and downstream of the effluent outfall using benthic invertebrates. The control samples collected upstream of the effluent outfall possessed an inherent toxicity relative to the laboratory controls, apparently due to the naturally occurring sodic content. Sediment samples collected downstream of the effluent outfall showed a greater toxicity than upstream controls. Ultimately, no correlation was ever established between elevated Site-related contaminants and toxicity.

Soil Quality

Surface and subsurface soil samples were collected from fields surrounding the Monsanto Plant. Regional control samples were collected from soils similar to those that surround the Plant in areas thought to be unaffected by Monsanto Plant emissions. For risk assessment purposes, EPA used results from the 0-to-1 inch depth interval as the most likely zone of human exposure. Contaminants elevated above background for the 0-to-1 inch depth interval were aluminum, arsenic, beryllium, cadmium, chromium, manganese, silver, vanadium zinc, lead-210, polonium-210, radium-226, thorium-230, and uranium-238. The elevated soil contaminants that exceeded risk-screening criteria for residential use and were thus considered contaminants of potential concern were arsenic, beryllium, cadmium, vanadium lead-210, polonium-210, radium-226, thorium-230, uranium-238. No soil constituents exceeded ecological screening levels. Tables showing these results in detail are included in Appendix A.

Many of the contaminants of potential concern were clustered outside the northern and southern boundaries of the Plant. The general distribution of contaminants of potential concern in the soils surrounding the Plant is shown in **Figures 4 and 5.**



Source: Soda Springs, Idaho Provisional Edition 1982, and Monsanto, Phase II RI Report (Golder, 1995).

EXPLANATION

S-x or S2-x ● Phase I soil sample locations

MS2-x ◉ Phase II soil sample locations

Constituent

Arsenic (As)
Beryllium (Be)
Cadmium (Cd)
Lead-210 (Pb-210)
Radium (Ra)-226
Uranium (U)-238
Zinc (Zn)

The values presented are from soil samples collected from 0–1" depth interval.

Metal (As, Be, Cd, Zn) concentrations are in mg/kg. Radionuclide (Pb-210, Ra-226, U-238) concentrations are in pCi/g. A "J" suffix indicates an estimated concentration and a "D" indicates the result of a duplicate sample.

N

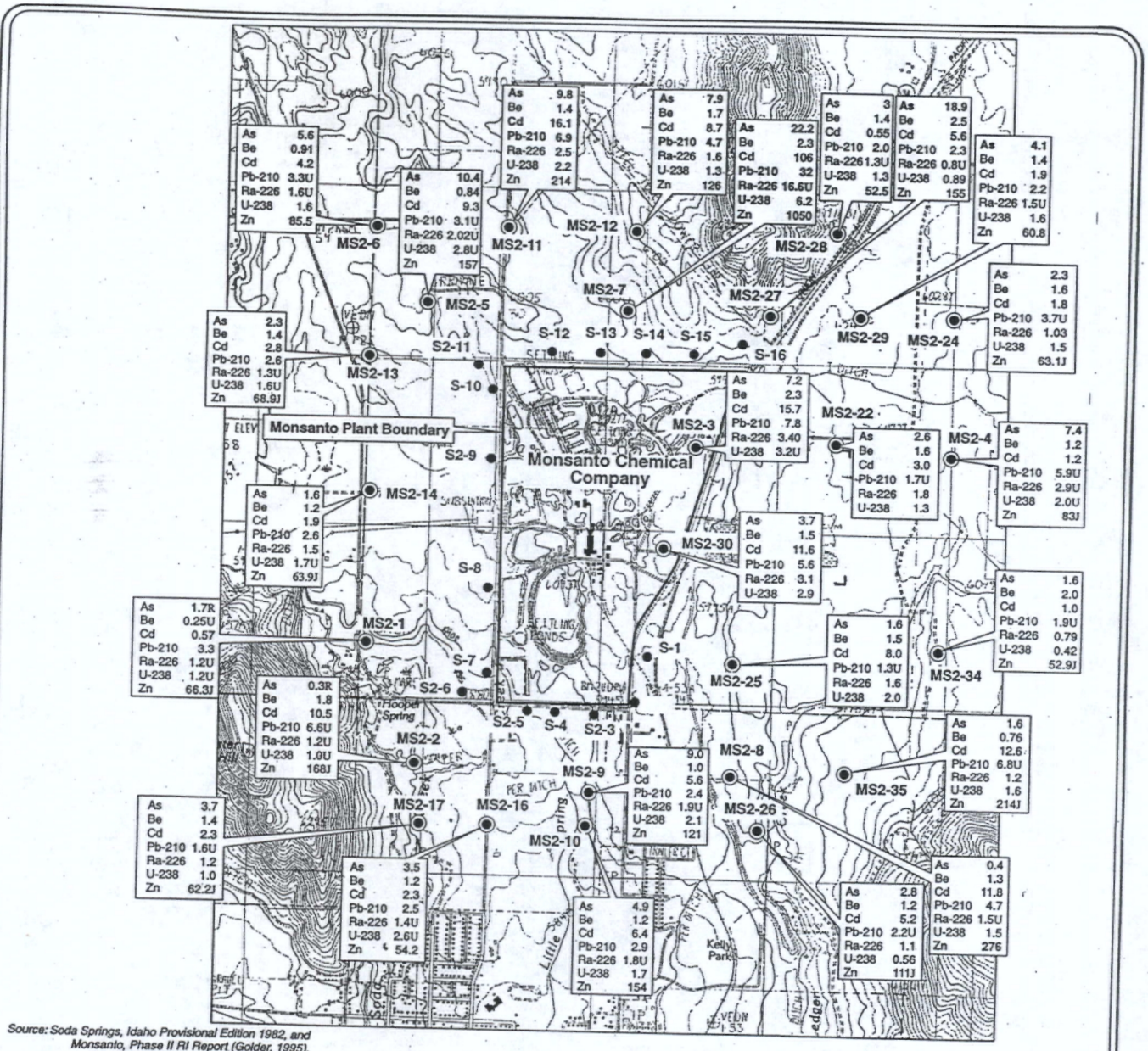
0 2000

Scale in Feet

Monsanto Site

CONCENTRATIONS OF CONTAMINANTS OF CONCERN IN SOILS - Phase 1 Samples

Figure 4



Source: Soda Springs, Idaho Provisional Edition 1982, and Monsanto, Phase II RI Report (Golder, 1995).

EXPLANATION

S-x or S2-x ● Phase I soil sample locations

MS2-x ◉ Phase II soil sample locations

The values presented are from soil samples collected from the 0"–1' depth interval.

Constituent

Arsenic (As)
Beryllium (Be)
Cadmium (Cd)
Lead-210 (Pb-210)
Radium (Ra)-226
Uranium (U)-238

Metal (As, Be, Cd, Zn) concentrations are in mg/kg. Radionuclide (Pb-210, Ra-226, U-238) concentrations are in pCi/g. A "U" suffix indicates the constituent was not detected at or above the concentration indicated, a "J" indicates an estimated concentration, and a "D" indicates the result of a duplicate

Monsanto Site

CONCENTRATIONS OF CONTAMINANTS OF CONCERN IN SOILS - Phase 2 Samples

Figure 5

Groundwater Quality

Groundwater from 60 well locations and 18 spring locations at and in the vicinity of the Monsanto Plant were sampled and chemically analyzed by Monsanto from the mid 1980's to the present. Control data were obtained from wells and springs upgradient of any known sources of constituent releases from the Monsanto Plant, and were separated according to groundwater type (fresh or sodic). Upper tolerance limits (UTLs) based on human consumption were established for the control data for each constituent in each groundwater type.

The maximum concentration of each constituent by groundwater region and groundwater type was compared to the corresponding UTL for that constituent (see Appendix A). Contaminants with maximum concentrations exceeding the UTL for each groundwater region and groundwater type were considered elevated contaminants. Of those, calcium, magnesium, potassium, and sodium are essential nutrients, and bicarbonate is a nontoxic substance, therefore these contaminants were eliminated from further consideration in the RI. Beryllium and chromium were detected sporadically, and were eliminated from further consideration.

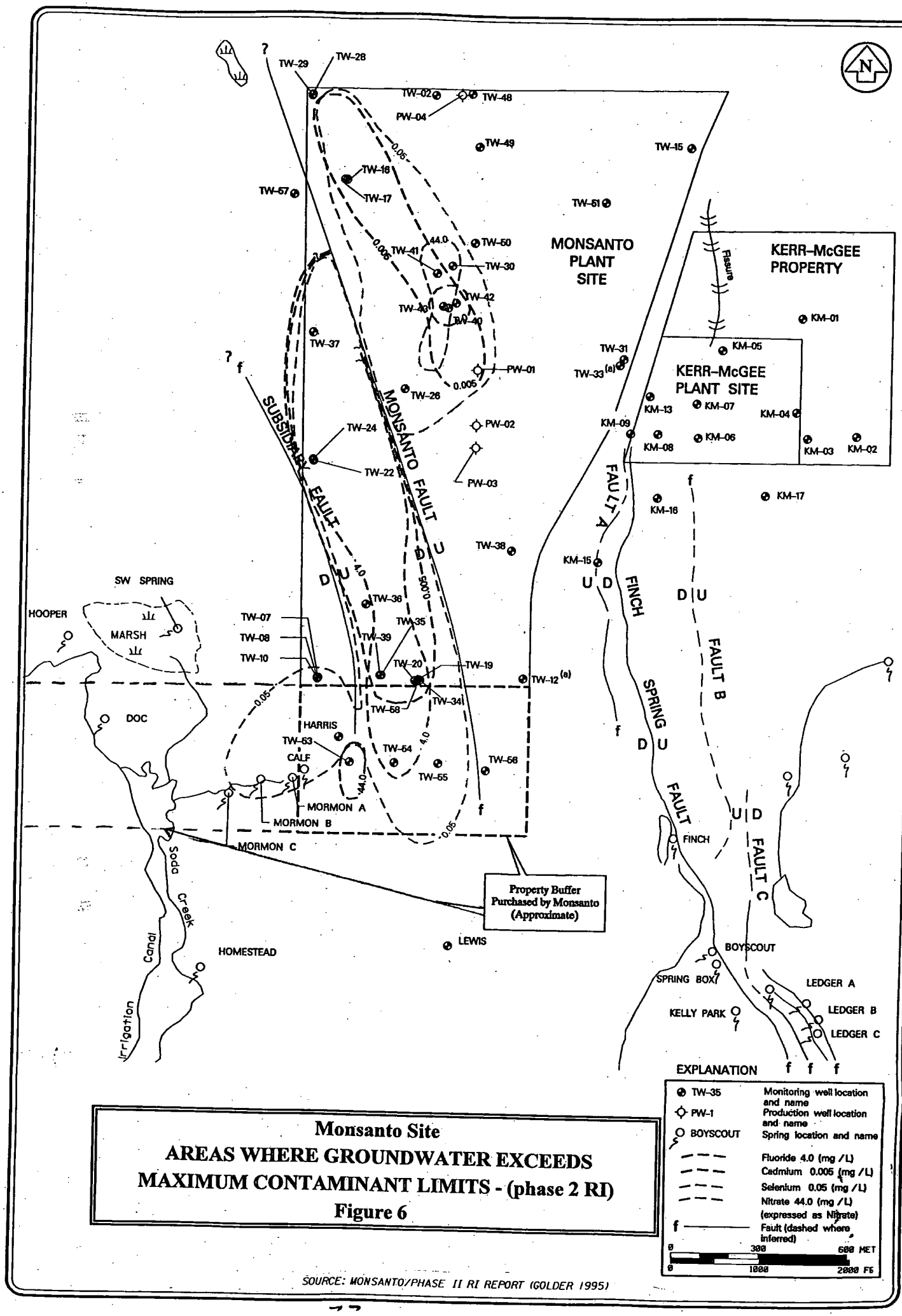
The remaining elevated contaminants were reviewed by preliminary risk-based screening. In this screening, the maximum concentrations of each elevated constituent (by groundwater region and type) were compared to background, MCLs, and human health risk-based concentrations using standard default values. Elevated contaminants with maximum concentrations exceeding the screening values in fresh groundwater were: ammonia nitrogen, arsenic, cadmium, chloride, fluoride, iron, manganese, molybdenum, nickel, nitrate, selenium, sulfate, vanadium, and zinc. Elevated contaminants with maximum concentrations exceeding screening values in sodic groundwater are the following subset of the fresh groundwater group: ammonia, nitrogen, arsenic, chloride, molybdenum, nickel and vanadium.

Chloride, iron, and sulfate failed preliminary risk-based screening solely due to exceedances of their respective secondary MCLs (e.g. odor, color). Since secondary MCLs are aesthetic-based rather than health-based criteria, these contaminants do not represent potential risks to human health and were eliminated from further consideration as contaminants of potential concern. Manganese also exceeded the secondary MCL. However, it was retained as contaminant of concern because of exceedences of risk-based concentrations (0.18 mg/l equated to an HI of 1 in the Monsanto and Kerr-McGee assessments) beneath the Plant, not the secondary MCL.

Off-Plant migration of contaminants has only been detected in the UBZ-2 groundwater region. Therefore, contaminants of potential concern for groundwater were identified as those elevated contaminants in the freshwater portion of UBZ-2 region that exceeded risk-based screening criteria, plus all Site-related contaminants which exceeded MCLs. These contaminants were cadmium, fluoride, manganese, molybdenum, nickel, nitrate-nitrogen and selenium. Tables showing these results in detail are included in Appendix A.

Biota Quality

As previously discussed, toxicity testing has been conducted on selected Soda Creek sediment samples. No effects on biota were identified that could be associated with the elevated concentrations of cadmium found in the sediments. No exceedances of water quality criteria for protection of aquatic organisms were identified.



Monsanto Site

AREAS WHERE GROUNDWATER EXCEEDS MAXIMUM CONTAMINANT LIMITS - (phase 2 RI)

Figure 6

SOURCE: MONSANTO/PHASE II RI REPORT (GOLDER 1995)

Population and Environmental Areas that Could Be Affected

The City of Soda Springs is located approximately one mile south of the Monsanto Plant and has a population of about 3,000. The Monsanto Plant employs about 400 people (who live in or near the City) and the adjacent Kerr-McGee Plant employs about 80 people.

According to the FS, properties adjacent to the Monsanto facility are owned by eleven different owners of record. To the East is Kerr-McGee and its 40 workers. To the southeast is the City of Soda Springs industrial park with more industrial properties and workers. Monsanto owns most of the property due south of the plant but does not currently make active use of it. There is one home about 0.2 miles south of the Plant. The property to the west is zoned agricultural (which allows for residential use) and is typically used for horse grazing. The nearest home to the west is the property owner's dwelling, approximately one half-mile away. The land to the north includes several parcels owned by different owners. The land is zoned agricultural and is currently in agricultural set-aside or being farmed, except one parcel which Monsanto owns.

Monsanto employee drinking water is supplied by production well PW-4 on the northern boundary of the Plant, which is upgradient of any potential Site-related sources of constituent releases. Kerr-McGee Plant drinking water is supplied by the City. Most local residents are on City water; no one is known to be using downgradient wells for drinking purposes and the City supplies are adequate for any anticipated population increase. The City obtains its drinking water from Formation Spring (located northeast of the Plant) and Ledger Spring (located to the southeast of the Plant). These springs are not threatened by the Site. There are no wells located down-gradient of the Monsanto Plant currently used for drinking water purposes.

Soda Creek, which receives non-contact cooling water discharges from the Plant and which is recharged by groundwater from beneath the Plant, is largely sodic near the Plant and increasingly fresh as it nears Alexander Reservoir. The Creek supports a limited range of species, apparently due to its sodic nature.

The one area of special historical interest in the vicinity of the Monsanto Plant that could potentially be affected by Site-related contamination or remedial actions is Hooper Spring, a soda-water spring downgradient from the Plant. Groundwater contamination could conceivably eventually reach Hooper Spring if concentrations do not attenuate as predicted.

The Plant and surrounding region is covered by a sagebrush-grass vegetational zone. Significant fish and wildlife habitats include the Bear River, Alexander Reservoir, and the Formation Cave vicinity (a property owned by the Nature Conservancy). Waterfowl have been known to use the non-contact cooling water ponds at the Plant throughout the year. The bald eagle was the only endangered species identified near the City. According to the US Fish and Wildlife Service, bald eagles winter in the Bear River/Alexander Reservoir area. The hoary willow is listed as a sensitive species. The willow is found along Ledger Creek. None of the above are known to be affected by constituent releases from the Site.

Contaminant Transport

Potentially significant constituent transport pathways for the Monsanto Plant, as defined by exceedences of preliminary risk-based screening results, are shown in Table 2.

Table 2

POTENTIALLY SIGNIFICANT CONSTITUENT TRANSPORT AND EXPOSURE PATHWAYS IDENTIFIED IN THE RI FOR THE MONSANTO PLANT

Air Transport	Inhalation of arsenic, beryllium, cadmium, fluoride, manganese, molybdenum, silver, vanadium, zinc, lead-210, polonium-210, radium-226, thorium-230, uranium-234, and uranium-238 derived from fugitive dust from source piles and roads, and from stack emissions from the Monsanto Plant.
Surface Water Transport	The discharge of contaminants in non-contact cooling water and groundwater to Soda Creek represents a potential transport pathway. No COCs were identified, however cadmium levels are elevated with respect to background.
Direct Contact with Soils and Source Piles	Ingestion of arsenic, beryllium, cadmium, lead-210, polonium-210, radium-226, thorium-230, and uranium-238 or external exposure to the radionuclides in the source piles or the soils adjacent to the Monsanto Plant.
Groundwater Transport	There is no current pathway for groundwater ingestion. Drinking water wells could be installed, although City water is available. There is a potential for future discharge of contaminants of concern (cadmium, fluoride, manganese, molybdenum, nickel, nitrate-nitrogen, and selenium) from beneath the Monsanto Plant to Soda Creek.

6. SUMMARY OF SITE RISKS

The data from the RI were evaluated in both a baseline human health risk assessment (HHRA) and an ecological risk assessment (ERA). These assessments utilized conservative (i.e., protective), yet reasonable exposure assumptions and scenarios to predict the likelihood of human health and environmental impacts resulting from Site-related contamination. Risk estimates are given in more detail in Tables 2-4, and Appendix A, which includes Tables identifying the concentrations of the contaminants of potential concern by media.

HUMAN HEALTH RISK ASSESSMENTS

EPA's Baseline Human Health Risk Assessment (HHRA)
The baseline risk assessment was prepared by EPA using information gathered by Monsanto for the RI/FS. Risk assessment data needs were identified in the initial planning for the RI and were refined as additional Site characterization was performed. All environmental samples collected and analyzed in the RI were evaluated for the risk assessment. Sufficient data were available to perform the baseline risk assessment, and data gaps identified were addressed before the RI/FS was considered complete.

The scope of the assessment included all potential chemical hazards and carcinogenic risks to human health attributable to uncontrolled releases of hazardous substances to the environment at or from the Plant in the absence of any remedial action. Actual and potential risks to human health in residential and industrial settings were evaluated under current and future scenarios.

The risk assessment was complicated by several factors, including:

- The fact that this is an operating industrial facility, and is likely to remain as such;
- The presence of radionuclide as well as chemical health hazards (radionuclide hazards have traditionally been measured and evaluated differently than chemical hazards);
- Relatively high levels of background radioactivity in the area;
- The complexity of the hydrogeology, reflecting the presence of fractured basalt and multiple ground water sources; and,
- The proximity to the Kerr-McGee facility, across the highway from the Monsanto Site. Kerr-McGee is also a Superfund Site. Separate RI/FS's were prepared for each Site; information from both Sites was considered in the selection of remedy.

<u>APPROACH AND KEY ASSUMPTIONS</u>

The baseline human health risk assessment was conducted using appropriate EPA and Superfund guidance. Both current and future scenarios were developed to evaluate potentially significant human health risks. Total hazards and risks were calculated by analyzing scenarios

based on multiple exposures within localized areas. All environmental samples collected and analyzed in the RI were evaluated for useability in the HHRA based on the scenarios selected.

Equations to assess chemical intake and associated risks, along with appropriate default parameters, were derived from EPA guidance documents. These exposure parameters yield conservative (i.e. health-protective) risk estimates. Key assumptions made before completing the risk assessment include:

- The Plant is an operating facility. Workplace exposures or risks that were not attributable to uncontrolled releases to the environment (e.g., exposure to high temperatures, noise or controlled emissions inside furnace buildings) were beyond the scope of the assessment. Such exposures are the purview of the Occupational Safety and Health Administration (OSHA);

- Chemical concentrations in environmental media and resulting exposures remain constant over time;

- Residences could be built in the most-contaminated areas adjacent to the plant;

- Ground water could be used in a future residential scenario for drinking and household use;

- Potential exposure associated with disposal of slag at the facility was evaluated. However, the use of slag in the community for roads, etc., is the subject of a separate study and was beyond the scope of this RI/FS; and,

- Except where Site-specific exposure information has been documented, EPA default parameters are representative of the potentially exposed populations.

The HHRA followed EPA guidance and used a deterministic (i.e., point-estimate) approach to identify those contaminants present in environmental media (e.g., off-Plant soil and groundwater) and on-Plant source materials that could potentially pose adverse health effects to current and future on-Plant workers and off-Plant residents.

The following exposure scenarios were developed based on local land use and EPA Region 10 risk assessment guidance (details of the exposure assumptions are provided in Appendix A):

- Current Occupational. Risks posed to individuals who currently work at the Plant were evaluated using modified exposure assumptions to account for local climate information (severe winter weather limits some exposure) and time-and-location data provided by Monsanto (to better quantify exposure durations at various locations within the plant). This evaluation focused on exposure to on-Plant source materials via ingestion, external radiation (for radionuclides), and inhalation of Site-related emissions (i.e., fugitive dusts and stack emissions).

- Future Occupational. Risks were calculated for individuals who were assumed to be exposed to on-Plant source materials using EPA default industrial

exposure assumptions. This approach assumed that unrestricted exposure to on-Plant materials or groundwater could occur in the event that the Monsanto Plant closed and the Plant was abandoned.

- Current Residential. Risks posed to individuals living beyond the Plant boundary were evaluated using soil samples nearest current residences. Exposures to soils surrounding the Plant via ingestion and external radiation (for radionuclides) and inhalation of Site-related emissions (i.e., fugitive dusts and stack emissions) were included in this scenario. No groundwater consumption was evaluated since groundwater is not currently used for drinking purposes.

- Future Residential. The exposure assumptions for the hypothetical future resident were similar to those for the current resident, except that local groundwater was assumed to be used as a source of drinking water for residents to the South. Note that future residential scenarios assume residential exposure to the highest concentrations in soils near the Plant, where no residences currently exist.

- **Site-specific Exposure Assumptions Used for Workers**:
The current industrial scenario evaluated exposure based on modified exposure assumptions, including:

  - **Source-Specific Estimates:** For risks to workers, exposure at each source of contamination was evaluated separately. Reasonable maximum exposures were evaluated by choosing source areas where relatively high concentrations occur. The areas also were selected based on the conceptual model, Site-specific exposure information provided by Monsanto, and COPC concentrations in the source materials. Specific sources evaluated included the underflow solids, nodules, treater dusts, slag, baghouse dusts, as well as road dusts.

  - **Exposure Durations:** EPA assessed risk to workers using both default and Site-specific exposure durations. Site-specific estimates were developed based on Plant-specific worker time-and-motion information provided by Monsanto and were used because they best represented potential exposures, which vary with proximity to different sources. The default assumption is 8 hours per day 250 days per year, while the revised estimates ranged from 1-6 hours per day for 160-250 days/year. The modified assumptions used in the final risk assessment are given in Table 1.

Toxicity Assessment

Quantitative estimates of toxic response developed by EPA were used to evaluate potential cancer and non-cancer toxicity of contaminants. Generally, cancer risks were calculated using toxicity factors known as slope factors, while noncancer hazards were estimated using reference doses. Toxicological uncertainty factors and critical effects were obtained from the EPA Integrated Risk Information System (IRIS), or if no IRIS values were available, from the Health Effects Assessment Summary Tables and EPA Environmental Criteria and Assessment

Office memoranda, as noted in the Risk Assessment.

Table 1 -- Exposure Assumptions for Current Industrial Scenario

Source Material	Task	Hours/ Day	Days/ Year	Shielding Factor
Baghouse Dusts	Reclaim Operator	1.5	250	0
Nodules	Bin Operator	1.5	250	0
Slag	Pot Carrier Operator	4	250	.45
Road Dusts	Water Truck Operator	6	160	.45
Treater Dusts	Loader Operator	1	250	.45
Underflow Solids	Loader Operator	6	180	.45

- **Shielding:** EPA used revised shielding factors based on data Monsanto collected from the cabs of the vehicles used by workers. The 95th percentile dose reduction factor was derived from Monsanto's dosimetry data for heavy vehicles. This value (0.55) was subtracted from 1 to yield a shielding factor of 0.45.

Risk Characterization

In summary, arsenic, beryllium, cadmium, and radionuclides (including lead-210, radium-226, thorium-230 and uranium-238) present in soils and source piles were identified in the HHRA as contaminants of concern at the Site because they pose carcinogenic risks greater than $1x10^{-6}$. The potential for other, non-cancer health effects were evaluated, but none were found which currently posed an HQ greater than 1 except manganese, as explained below. Risks associated with ingestion of groundwater were evaluated for the future residential scenario. Future residents or well-users living south of the Plant could be exposed to contaminants in groundwater that exceed primary MCLs (i.e., cadmium, fluoride, nitrate, and selenium), or risk-based concentrations (manganese, potentially) if wells were installed and the groundwater were used as a source of drinking water. Manganese currently exceeds risk-based concentrations only beneath the Plant.

Carcinogenic risks associated with external exposure to radium-226 were determined to be the principal concern for both on-Plant source materials and soils surrounding the Plant, for most scenarios. The exception was the current residential scenario, for which excess carcinogenic risks from metals (1E-5) are higher than radionuclide risk (4E-6) because that scenario used samples nearest current residences. More contaminated samples from closer to the Plant boundary fence were not used in the current scenario, since no residences are currently located there, or those risk estimates would have been higher. For the future residential risk scenario, estimates were done using sample locations closer to the fence and therefore the estimated risks are higher. Ingestion of metals (arsenic, beryllium) was also of concern in the future residential scenarios. The results of the HHRA are summarized in Tables 2 and 3.

Table 2 : Incremental Risk Over Background - Industrial Scenarios

	CURRENT SCENARIO RISK			FUTURE SCENARIO RISK		
	Site[a]	Background[b]	Increment over Background	Site[a]	Background[b]	Increment over Background
BAGHOUSE DUST AREA						
Metals	3E-5	1E-6	3E-5	7E-5	2E-6	7E-5
Radionuclides	6E-4	3E-5	6E-4	1E-3	6E-5	1E-3
NODULES AREA						
Metals	1E-5	6E-7	1E-5	5E-5	2E-6	5E-5
Radionuclides	5E-4	2E-5	5E-4	2E-3	6E-5	2E-3
SLAG AREA						
Metals	5E-5	2E-6	5E-5	5E-5	2E-6	5E-5
Radionuclides	2E-3	6E-5	2E-3	2E-3	6E-5	2E-3
ROAD DUSTS AREA						
Metals	3E-5	1E-6	3E-5	5E-5	2E-6	5E-5
Radionuclides	8E-4	3E-5	8E-4	2E-3	6E-5	2E-3
TREATER DUST AREA						
Metals	4E-5	2E-6	4E-5	4E-5	2E-6	4E-5
Radionuclides	1E-3	6E-5	1E-3	1E-3	6E-5	1E-3
UNDERFLOW SOLIDS AREA						
Metals	9E-5	2E-6	9E-5	1E-4	2E-6	1E-4
Radionuclides	1E-3	5E-5	1E-3	2E-3	6E-5	2E-3

a = includes ingestion, external, and inhalation
b = includes ingestion and external

Table 3: Incremental Risk Over Background - Residential Scenarios

	SCENARIO RISK			
	Site[a]	Background[b]	Increment over Background	
			Ingest, External	Inhalation
CURRENT SOUTHERN RESIDENTIAL LOCATION # I*				
Metals	6E-05	2E-05	3E-05	1E-05
Radionuclides	2E-03	3E-04	2E-03	1E-05
CURRENT SOUTHERN LOCATION II*				
Metals	4E-05	2E-05	1E-05	1E-05
Radionuclides	2E-05	3E-04	BB	2E-05
CURRENT WESTERN RESIDENCE*				
Metals	2E-05	2E-05	BB	3E-06
Radionuclides	9E-06	3E-04	BB	2E-06
CURRENT NORTHERN RESIDENCE*				
Metals	1E-05	2E-05	BB	3E-06
Radionuclides	6E-06	3E-04	BB	2E-06
FUTURE SOUTHERN LOCATION*				
Metals	5E-05	2E-05	3E-05	9E-05
Radionuclides	2E-05	3E-04	BB	2E-05
FUTURE NORTHERN LOCATION I*				
Metals	1E-04	2E-05	1E-04	2E-05
Radionuclides	2E-03	3E-04	2E-03	3E-05
FUTURE NORTHERN LOCATION II*				
Metals	5E-05	2E-05	2E-05	9E-06
Radionuclides	4E-04	3E-04	1E-04	9E-06

a = includes ingestion, external, and inhalation
b = includes ingestion and external
BB = Risk from COCs in soil below soil background risk

* See Appendix A for Map of Locations Used in HHRA

Table 4
Summary of RME Residential Risks in Excess of Background Risks

Residence	Ingestion		External		Inhalation	
	≤E-4	>E-4	≤E-4	>E-4	≤E-4	>E-4
CURRENT SOUTHERN I						
Metals	As, Be				As, Be, Cd	
Radionuclides	Pb-210+D Ra-226+D		U-238+D	Ra-226+D	Th-230 U-238+D	
CURRENT SOUTHERN II						
Metals	As, Be				As, Be, Cd	
Radionuclides					Th-230 U-238+D	
CURRENT WESTERN						
Metals					Cd	
Radionuclides					U-238+D	
CURRENT NORTHERN						
Metals					Cd	
Radionuclides					U-238+D	
FUTURE SOUTHERN						
Metals	As, Be (F, Se)[a]				As, Cd	
Radionuclides					Th-230 U-238+D	
FUTURE NORTHERN I						
Metals	As, Be				As, Cd	
Radionuclides	Pb-210+D Ra-226+D		U-238+D	Ra-226+D	Pb-210+D Th-230 U-238+D	
FUTURE NORTHERN II						
Metals	As, Be				As, Cd	
Radionuclides	Pb-210+D		U-238+D	Ra-226+D	Th-230 U-238+D	

a = Hazards from ingestion of ground water

Uncertainties

Uncertainties associated with the risk assessment include:

- The use of conservative assumptions with regard to exposure parameters in future scenarios and for current scenarios where Site-specific data was not available.

- Some assumptions regarding future land uses surrounding the Plant such as new residences adjacent to the Plant, or drinking water wells in contaminated groundwater, are highly speculative (the Plant itself was assumed to remain industrial);

- The Reasonable Maximum Exposure scenarios only represent a small subset of the existing workforce. It was assumed that individuals working indoors are not exposed to releases from the source areas under consideration;

- Because of the dynamic nature of the numerous job tasks at the Monsanto Plant, some individuals may be exposed to more than one source area or may spend a longer time at a particular source area, than what was assumed under the RME scenarios. Therefore risks may be underestimated;

- The residential scenarios are default factors that assume that the individuals stay at home for 24 hours/day, 350 days/year, for 30 years. This is likely an overestimation of the amount of time that people are actually at their residences;

- Agricultural exposures were not evaluated in detail. It was assumed that an incremental risk will occur from working in contaminated agricultural soils, but no measurements or Site-specific estimates were prepared. However, the individual is not expected to receive risks greater than under the industrial scenario, and in any event should be less than the conservative residential scenario.

Uncertainties Related to Radionuclide Risks

There were several uncertainties related to radionuclide risk identified in the Risk Assessment and subsequent to it that have been considered in this remedy. These include the following:

- The calculation of risk from external exposure assumed that any gamma-emitting radionuclide in soil is uniformly distributed in that soil within a finite soil depth and density, and dispersed in an infinite plane geometry. The depositional pattern of radionuclides in soils outside the Plant boundary forms a steep concentration gradient outward from the perimeter. In addition, most of the radionuclides were deposited in a surficial layer (0 to 1 inch depth), resulting in irregular vertical distributions. These non-uniform distributions result in uncertainties that tend to overestimate risks.

- In 1995, subsequent to completion of the HHRA, EPA revised the slope factors for radionuclides in HEAST. The revised factors increased the risk associated with radionuclides by almost 100% for the population from ages 0-30 and by about 20% for the general population. Given the revised slope factors, the risk assessment likely

underestimated the associated risks. However, EPA determined that the estimates in the HHRA were representative and adequate for risk management decision-making at this Site.

- In order to maintain comparability with other risk assessments, for radionuclide risks EPA used the default slope factors for the general population, which conservatively address all populations. Consequently, the slope factors used in the risk assessment may **have overestimated** risks posed to adult workers.

Monsanto's Stochastic Risk Assessment

Subsequent to the release of EPA's HHRA, Monsanto released its own probabilistic, or stochastic risk assessment (SRA). The aim of this document was to refine the exposure assumptions, toxicity values, and risks presented in EPA's HHRA. The SRA focussed solely on risks associated with external exposure to radium-226 and ingestion of arsenic. Due to numerous inconsistencies between the SRA and EPA guidance (and CERCLA requirements), the SRA was of limited utility in the risk-based decision-making process.

ECOLOGICAL RISK ASSESSMENTS

EPA's Ecological Risk Assessment

EPA's Baseline Ecological Risk Assessment (ERA) results were considered in the development of remedial action objectives (RAOs) in the FS. The baseline ERA indicated that the potential for terrestrial ecological risks or effects to sensitive/threatened species appeared to be minimal outside the Monsanto Plant boundaries; however, potential aquatic effects were noted. Neither EPA nor the State of Idaho had sediment quality criteria for the elevated contaminants of potential concern. For comparison purposes, surrogate values from Wisconsin and Ontario were used to identify the following contaminants of potential concern: arsenic, cadmium, copper, nickel, and selenium.

Subsequent to completion of the baseline ERA, Monsanto examined the potential risks associated with contaminants in Soda Creek. While elevated concentrations of several contaminants were indicated and some effects were identified, the contaminants were not statistically correlated with ecological effects. The final ecological assessment concluded that ecological impacts were unlikely, and that ecological risk-based target cleanup levels (TCLs) should not be used to set remediation goals.

NEED FOR ACTION

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Where the baseline risk assessment indicates that cumulative site human health risk using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk range, or if MCLs or non-zero MCLGs are exceeded, action under CERCLA is generally warranted at the site. Assuming no further action is taken to reduce risk, risks at the Monsanto Site exceed 10^{-4} for radionuclides and background for metals under the future residential and industrial scenarios. In addition, contaminant concentrations in groundwater exceed MCLs beneath and to the south of the Plant. Action is therefore warranted at this Site.

REMEDIAL ACTION OBJECTIVES

This section addresses the NCP requirements to establish remedial action objectives specifying the contaminants and media of concern, potential exposure pathways, and final remediation goals when the remedy is selected.

Background on Remedial Action Objectives

The NCP requires that remediation goals establish acceptable exposure levels that are protective of human health and the environment, taking into consideration ARARs, if available. For known or systemic carcinogens, the NCP says that "acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at the site or multiple pathways of exposure."

OSWER Directive 9355.0-30, dated 4/22/91, further clarifies the role of the baseline risk assessment in Superfund risk management decisions as follows:

> "EPA uses the general 10^{-4} to 10^{-6} risk range as a "target range", within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e.,), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1×10^{-4}, although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective. When an ARAR for a specific chemical (or in some cases a group of chemicals) defines an acceptable level of exposure, compliance with the ARAR will generally be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as

exposure to multiple contaminants or pathways of exposure). Conversely, in certain situations EPA may determine that risks less than 1×10^{-4} are not sufficiently protective and warrant remedial action.

Where current conditions have not resulted in a release posing risks that warrant action but there is a significant possibility that a release will occur that is likely to result in an unacceptable risk, remedial action may also be taken. The significance of the potential future release may be evaluated in part based on the quantities of material at the site and the environmental setting."

Preliminary Remediation Goals and FS Target Cleanup Levels

After EPA determined that action is necessary at this Site under CERCLA, remedial action objectives, including preliminary remediation goals (PRGs), were established for three environmental media: groundwater, soils surrounding the Plant, and on-Plant source materials (as past and potential future sources of releases to surrounding soils).

A range of preliminary remediation goals and target cleanup levels (TCLs) was developed in the FS. Monsanto evaluated remedial alternatives for the Site with respect to target cleanup levels based on a 1×10^{-6} human health risk, a 1×10^{-4} human health risk, a 5×10^{-4} human health risk, the Uranium Mill Tailings Radiation Control Act (UMTRCA) regulations, and on potential ecological risks only.

TCLs for radionuclides were derived by comparing the preliminary remediation goals to the upper tolerance limit of background concentration (based on the 95th percentile of the distribution of all background data) for a particular constituent, and using the greater of the two values. For example, the "TCL^{-4}" for radium-226 was determined by comparing the PRG associated with a 1×10^{-4} excess cancer risk (2.5 picocuries per gram of soil [pCi/g]) to the upper tolerance limit background concentration (3.3 pCi/g). Because the upper tolerance limit was greater than the PRG, the upper tolerance limit was assigned as the TCL. Because the HHRA identified risks due to radium-226 exposure in soils surrounding the Plant as contributing the vast majority of total risk, and background radionuclide concentrations pose potential risks of about 10^{-4} even in the absence of Site related contamination, the FS focused on that TCL as the basis for evaluating the alternatives.

Since EPA has cited the UMTRCA regulations as the principal radiation-specific federal requirements at other NPL sites, those regulations were given consideration. However, they are not ARARs because they are intended for the clean up of uranium and thorium mill tailing sites, and appropriate for industrial land uses, not mixed agricultural and residential use.

Before it was determined that no final remedial action objectives are necessary for protection of the environment, ecological PRGs were developed for use in evaluating FS alternatives for off-Plant soils. The PRGs were developed for protection of plants and mice.

Final remediation goals in this ROD were selected after reviewing the nine criteria analyses for all alternatives.

Remedial Action Objectives for Groundwater

The Contaminants of Concern (COCs) in groundwater are fluoride, cadmium, selenium, and nitrate, all of which exceed primary MCLs, and manganese, which exceeds risk-based concentrations (HQ > 1). No one is currently drinking the affected groundwater. The exposure pathway of concern for human health is potential consumption of contaminated groundwater beneath or south of the Plant. The groundwater RAOs for the selected remedy are:

> Prevent human ingestion of, inhalation of, or direct contact with ground water at levels exceeding MCLs for F, Cd, Se, and NO-3, or risk-based concentrations for manganese.

The ultimate goal of the remedy is to ensure that groundwater contamination sources have been eliminated and that natural attenuation will eventually restore the groundwater aquifers affected by past releases from the Site.

Remedial Action Objectives for Contaminated Soils Outside the Plant Boundaries

The COCs in soils outside the Plant boundaries are radionuclides and metals (arsenic and beryllium). The exposure pathways of concern for humans include external exposure to radionuclides, ingestion of radionuclides and metals, and inhalation of radionuclides and metals at levels that exceed background and pose an unacceptable cumulative estimated risk. The final RAOs and remediation goals for this media are:

> <u>For Human Health</u>
> Prevent external exposure to radionuclides in soils at levels that pose cumulative estimated risks above 3×10^{-4}. Such risks correspond to a radiation effective dose equivalent of approximately 15 mrem/year for the radionuclides of concern at this Site.
>
> Prevent ingestion or inhalation of soils containing radionuclides at levels that pose cumulative estimated excess risks above 3×10^{-4}, or metals (arsenic, beryllium) at levels that pose cumulative estimated excess carcinogenic risks that exceed 1×10^{-5}, a non-cancer risk HQ of 1, or Site-specific background levels where that is not practicable.

Rationale for Soil Remediation Goals

ARARs are not available for radionuclides in residential soils, therefore acceptable exposure levels were developed. The selected remedy for this Site includes soil cleanup of radionuclides to concentrations which pose a risk of 3×10^{-4} or less above background, assuming residential land use, using EPA's slope factors and risk assessment methodology. At this Site, the 3×10^{-4} risk goal corresponds to a radium-226 concentration in soils of 3.7pCi/g and a radiation effective dose equivalent of approximately 15 mrem/year for the radionuclides of concern.

This goal corresponds to the upper end of the range for cancer risks considered protective at most CERCLA sites. EPA may consider risk estimates slightly greater than 1×10^{-4} to be protective based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. For this Site, these conditions include the naturally-occurring background concentrations of the radionuclides of concern, which exceed

$1x10^{-4}$ risk and thus make lesser concentrations unattainable, the lack of a uniform distribution of contaminants in soils, current land use, and associated uncertainties.

The $3x10^{-4}$ risk goal for radionuclides is also consistent with levels considered protective in other governmental actions including regulations and guidance developed by EPA in other radiation control programs including: (1) EPA's Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 C.F.R 191) which sets a dose limit of 15 mrem/year (equivalent to a risk of $3x10^{-4}$ over 30 years) and (2) EPA's National Emission Standards for Hazardous Air Pollutants (40 C.F.R 61) which sets a standard for radionuclide emissions from operating elemental phosphorus production facilities such as this one equivalent to a risk of approximately $3x10^{-4}$.

To further reduce cumulative excess risk in areas where radionuclides exceed cleanup goals, the selected remedy will also address metals which exceed background and pose an excess carcinogenic risk above $1x10^{-5}$ (arsenic, beryllium), or a non-cancer risk with an HQ of 1 or more (none identified). This remediation goal was established after first considering the 10^{-6} point of departure. However, since local background for some of these metals poses > 10^{-6} risk, the 10^{-5} level is the most protective risk level which is measurable and above background.

RAO for Sources of Soil Contamination (Solid Waste Piles)

Solid waste piles on-Plant have in the past been sources of contaminant migration to off-Plant soils. If workers were frequently exposed to uncontrolled emissions from such piles, risks would be unacceptable. Preliminary RAOs were developed for source piles for use in the FS. However, under current conditions, migration to off-Plant soils has been significantly reduced and effective worker protection programs are in place, so RAOs are not necessary for source piles as long as these controls remain in place and off-Plant soil concentrations do not increase.

Future On-Plant

Despite potential risks in excess of the risk range (>10^{-3}), cleanup alternatives were not developed for alternative future industrial scenarios within the Plant because Monsanto is considered highly likely to continue to operate the Plant for the foreseeable future. Monsanto has just increased production and maintains it has the reserves to profitably operate the Plant for over 30 more years.

OSHA-EPA Jurisdiction and Worker Risk Issues

As part of the HHRA, EPA evaluated risks to workers within the operating portion of the Plant from exposure to uncontrolled releases of hazardous substances. This is necessary at all CERCLA sites to identify risks which may require remediation and to help guide the study of feasible alternatives to address such risks. Since EPA and OSHA have complementary jurisdiction at operating facility sites, EPA determined that OSHA should be consulted and informed if potential risks to workers were identified, and as appropriate, OSHA standards should be part of the FS and risk management decision-making at the Site. At the conclusion of the HHRA and FS, OSHA was informed that the RI/FS identified no uncontrolled releases which pose unacceptable threats to workers health or safety under current conditions.

7. DESCRIPTION OF ALTERNATIVES

In the FS, eight basic remedial alternatives were developed and then evaluated according to a range of target risk levels that were considered in the decision process. The remedial alternatives were developed, evaluated and compared on the basis of effectiveness, implementability, and cost for their ability to achieve the RAOs at multiple cleanup levels. This resulted in 44 alternatives being described and compared in the FS . Those remedial alternatives that were no more effective at achieving the RAOs but cost significantly more were eliminated. Five alternatives were retained for consideration for the final remedy. Table 5 presents a summary of these alternatives.

The following discussion addresses each alternative in terms of its treatment, containment/ storage and groundwater component and provides an estimation of the implementation time frame and cost. A discussion of applicable, relevant, and appropriate requirements (ARARs), risk based levels, or requirements "to be considered" (TBCs) also is provided.

A common element for each of the alternatives discussed is the inclusion of five-year reviews.

In order to facilitate the evaluation of alternatives, the FS discussion focussed on a preliminary remediation goal based on TCL^{-4}, after which additional information was provided on how different cleanup goals might affect the remedy in terms of protectiveness, implementability and/or cost. The final remediation goal selected, the rationale for it, and the estimated cost of the selected remedy are discussed in Section 9, the "Description of the Selected Remedy".

Note on Development of Groundwater Alternatives

While the exceedence of MCLs is sufficient reason to consider remedial action for groundwater, based on the success of past remedial actions, the characteristics of the groundwater, modeling which showed that groundwater is expected to recover and achieve MCLs at the southern Plant boundary in 5-30 years, and knowledge of the expected cost effectiveness of groundwater treatment at low concentrations, Monsanto proposed and EPA agreed to evaluate only a limited range of groundwater alternatives, none of which included treatment.

As part of the RI, Monsanto and its contractors performed groundwater fate and transport modeling and submitted a report to EPA in 1993. Based on the modeling, without further action concentrations of constituents in groundwater at the southern Plant boundary will be restored to background levels within 5 to 30 years, depending on the constituent and its retardation in groundwater.

Groundwater monitoring data over several years has shown that concentrations of contaminants of concern are generally decreasing, and that current plant operations essentially capture the plume (pumping of production wells for non-contact cooling water creates a cone of depression which is retarding the spread of contaminants and also pumps contamination out. That groundwater is discharged through the NPDES-permitted discharge to Soda Creek; the NPDES permit only addresses pH and temperature. The discharged water was found to contain Site-related constituents at levels below action levels.) To ensure protectiveness the groundwater monitoring alternatives include monitoring of or below the discharge outfall.

ALTERNATIVE 1: NO FURTHER ACTION

No remedial action would be taken under this alternative. It has been included to provide a basis for comparison of the other alternatives.

Treatment Components

Alternative 1 does not entail any further treatment for on-Plant source materials or off-Plant soils.

Containment/Storage Components

No further action will be conducted to address on-Plant source materials or soils surrounding the Plant.

Groundwater

Groundwater predictions indicated that past remedial actions, ongoing groundwater pumping, and natural attenuation processes will eventually result in concentrations decreasing to background levels throughout the aquifer. Fate and transport modeling conducted during the RI concluded that groundwater at the southern Plant boundary (1996 fence line) will be restored to background levels by natural processes within 5 to 30 years.

General Components

No further action will be taken to address on-Plant sources, off-Plant soil, or groundwater.

There are no treatability studies, implementation requirements, or institutional controls associated with this alternative. As no groundwater monitoring would be included, there are uncertainties associated with evaluating whether groundwater concentrations are decreasing over time. Furthermore, there is no mechanism to prevent the ingestion of groundwater with contaminants including MCLs or risk based criteria.

There are no costs associated with implementing this alternative.

ARARs

Alternative 1 includes No Action and has no ARARs.

ALTERNATIVE 2: GROUNDWATER MONITORING

Under Alternative 2, no remedial action would be implemented for on-Plant materials and soils surrounding the Plant. However, a groundwater monitoring program would be implemented and continued until groundwater achieves MCLs, which is projected to take from 5-30 years. A thirty year monitoring program is assumed for cost estimation purposes.

Treatment Components

Same as Alternative 1.

Containment/Storage Components

Same as Alternative 1.

Groundwater

In addition to the natural attenuation descried under Alternative 1, this alternative also includes a 30-year groundwater monitoring program and monitoring of the Plant discharge outfall to evaluate the trend for contaminant concentrations. Five-year Site reviews would be conducted until groundwater achieves MCLs and risk-based concentrations at the Point(s) of Compliance. The program may be discontinued or extended based on concentration trends. It is assumed that the RI/FS monitoring program of semiannual sampling of approximately 60 monitoring wells and springs will be reduced after the ROD to about 25-30 wells and springs, including wells in both the UBZ and LBZ zones and the Plant discharge outfall. Groundwater modeling done for the RI/FS indicates that the concentrations of contaminants of concern in groundwater at the Monsanto Plant's southern boundary should return to background levels in 5 to 30 years.

The analytes in groundwater will include cadmium, fluoride, manganese, nitrate, and selenium.

General Components

No further action would be taken to address on-Plant sources, soils surrounding the Plant, or groundwater. No reduction in risk is associated with this alternative. The groundwater monitoring program would be conducted for 30 years.

Costs are summarized as follows:

Capital Cost	$ 0
Annual Operations and Maintenance (O & M) Cost	$ 79,300
Present Worth	$1,010,000

ARARs

There are no ARARs which pertain to implementation of this alternative, which is intended to supply the information necessary to determine when groundwater achieves ARARs (i.e., MCLs). It would not in itself satisfy the groundwater MCLs, which are ARARs.

Alternative 4: LAND USE AND ACCESS RESTRICTIONS, AND GROUNDWATER MONITORING

Alternative 4 includes use and access restrictions for soils surrounding the Plant, and use and access restrictions and a groundwater monitoring program for groundwater. Note that when this alternative was evaluated in the FS, dust controls had not been applied yet and so were considered part of the alternative. Since such controls have since been established and fugitive emissions are regulated under the State of the Idaho Air Pollution Control regulations and the Clean Air Act as implemented by the State of Idaho, dust emission control was not considered part of this alternative by EPA during the selection of remedy.

For soils surrounding the Plant, land-use restrictions include the use of environmental easements or similar enforceable deed restrictions on the property to limit future land use, including potential residential development where appropriate, and crop restrictions to prevent affected property owners from growing food crops for human consumption. Access restrictions would include establishing a property buffer around the Plant.

Treatment and Containment/Storage Components Components

This alternative does not include any treatment, containment or storage.

Groundwater

Groundwater monitoring provisions are the same as Alternative 2. In addition, land-use restrictions for groundwater include the use of environmental easements and similar deed restrictions to prevent affected land owners from installing wells for potable water use. Access restrictions could include establishing a property buffer around the Site to allow Monsanto to effectively control water use.

General Components

Risk reduction associated with this alternative comes from institutional controls that would prevent human exposure to contaminated soils and groundwater and monitoring to ensure that groundwater recovers and soils are not re-contaminated. Costs for Alternative 4 are estimated for a period of 30 years, but may need to be in place for a longer or shorter period of time.

Costs are summarized as follows:

Capital Cost	$ 570,105
Annual O & M Cost	$ 159,820
Present Worth	$ 2,570,000

ARARs

Key ARARs for this alternative are summarized in Table 5. There are no chemical specific ARARs for soils surrounding the Plant. In addition, while they are not ARARs, on-Plant source controls will comply with state and federal clean air act monitoring and reporting requirements.

Alternative 5: IN SITU BIOLOGICAL TREATMENT, LAND USE AND ACCESS RESTRICTIONS, AND GROUNDWATER MONITORING

Alternative 5 includes in-situ biological treatment for soils surrounding the Plant, and land use and access restrictions and a groundwater monitoring program for groundwater. In-situ bioremediation was identified in the FS as the most promising treatment alternative available for the soil contaminants and conditions at this Site.

Treatment Components

Dust control measures are the same as for Alternative 4.

For soils surrounding the Plant, in-situ biological treatment would be used to reduce constituent concentrations. The process would consist of growing crops capable of accumulating the contaminants of concern in plant tissue, and then disposing of the contaminated crops in a hazardous waste landfill if needed. Over time (estimated 7 years) the remaining soil would be rendered non-hazardous and available for unrestricted use.

Containment/Storage Components

This alternative does not include any containment or storage components.

Groundwater

Same as Alternative 4.

General Components

Risk reduction would result from biological treatment of soils surrounding the Plant to reduce the toxicity, mobility, and volume of contaminated material. Original excess risk levels, estimated in the HHRA, were as high as 2×10^{-3} from ingestion and external radiation risks from radium-226 exposure.

Alternative 5 would be in effect for a period of 30 years. Operating costs are summarized as follows:

Capital Cost		$ 305,006
Annual O & M Cost	(Years 1-5)	$ 660,487
	(Years 6-10)	$ 157,200
Present Worth		$ 4,400,000

ARARs

Same as Alternative 4. In addition, disposal of material from the biological treatment of soil will comply with hazardous waste requirements and land disposal restrictions. Key ARARs for this alternative are summarized in Table 5.

Alternative 8: SOIL EXCAVATION/ REPLACEMENT/CONTAINMENT ON-PLANT, PLUS GROUNDWATER MONITORING

Alternative 8 includes contaminated soil removal, replacement, and disposal of contaminated soils by containment within the Plant; and for groundwater, land use and access restrictions and a groundwater monitoring program.

Treatment Components

For soils surrounding the Plant, the upper six inches of affected soil will be removed and used as cover material for the on-Plant source material piles. The estimated volume of surrounding soils with constituent concentrations greater than the remediation goal of $3x10^{-4}$ is estimated to be as much as 200,000 cubic yards (equivalent to an area of about 250 acres, of which Monsanto owns about 1/5th). The remediated off-Plant areas would be restored by placing clean fill material within the excavated area and re-vegetating the area. There are no chemical specific ARARs for soils surrounding the Plant.

Containment/Storage Components

Excavated soils brought onto the Plant could be used as cover but would have to be contained sufficiently to ensure they would not migrate to soils or groundwater.

Groundwater

Same as Alternative 4.

General Components

Risk reduction would result from the removal of soils surrounding the Plant to reduce the toxicity, mobility, and volume of contaminated material. Risk levels estimated in the HHRA were as high as 2×10^{-3} from ingestion and external radiation risks from radium-226 exposure. Alternative 8 would be in effect for a period of 30 years.

Operating costs are summarized as follows:

Capital Cost	$ 13,854,274
Annual O & M Cost	$ 159,820
Present Worth	$ 15,860,000

ARARs

Same as Alternative 5. In addition, removal and disposal of off-Plant soil will be done in a manner which complies with Idaho solid waste management regulations. Key ARARs for this alternative are summarized in Table 5.

TABLE 5
SUMMARY OF ALTERNATIVES RETAINED FOR ANALYSIS AND POTENTIAL ARARs

	Alternatives				
	1	2	4	5	8
Media					
On-Plant Sources	No Action	No Action	Dust Control	Dust Control	Dust Control
Off-Plant Soils	No Action	No Action	Land-Use Restrictions* Access Restrictions	In-Situ Biological Treatment	Excavate/Contain On-Plant
Groundwater	No Further Action	Monitoring	Monitoring, Access/Land Use Restrictions	Monitoring, Access/Land Use Restrictions	Monitoring, Access/Land Use Restrictions
Potential ARARs requiring compliance:					
29 CFR 1910 and 29 CFR 1926 (Regulate Worker Health/Safety)		X	X	X	X
40 CFR 50 (Primary and Secondary Air Quality Standards)			X	X	X
40 CFR 141 (National Drinking Water Standards)		X	X	X	X
40 CFR 261 (Identification and Listing of RCRA Hazardous Wastes)			X	X	X
40 CFR 264 (Standards for Owners & Operators of Hazardous Waste Treatment, Storage, Disposal Facilities)				X	X
40 CFR 268 (Land Disposal Restrictions)				X**	X**
40 CFR 302 (Designation, Reportable Quantities and Notification)		X	X	X	X
IDAPA 16.01.01.01.651.2 (Idaho Air Pollution Control Regulations)			X	X	X
IDAPA, Sections 16.01.2000 et.seq. (ID Water Quality and Wastewater Treatment Requirements)		X	X	X	X
IDHW, Title 1, Chapter 6, Sec. 01.6001 et. seq.		X	X	X	X
IDHW, Title 1, Ch 6, Sections 01.6001 (Idaho Solid Waste Management Regulations)		X	X	X	X

* Includes property buffer
** If material must be disposed of off-site

ARAR = Applicable or relevant and appropriate requirements
CFR = Code of Federal Regulations
IDAPA = Idaho Administrative Procedures Act
IDHW = Idaho Department of Health and Welfare

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analyses assess the relative performance of each alternative evaluated in detail in the FS with respect to the nine NCP evaluation criteria. The objective of this comparison is to assess relative advantages and disadvantages of alternatives and identify the key trade-offs that must be balanced in selecting a preferred alternative.

THRESHOLD CRITERIA

1. Overall Protection of Human Health and the Environment

a) **On-Plant Source Materials. Alternatives 4, 5, and 8** provide adequate protection of human health and the environment by monitoring of soils surrounding the Plant (to ensure that the Source Material piles, which have been the sources of releases, have in fact been adequately controlled) and periodic review of Plant compliance with applicable environmental requirements. **Alternatives 1 and 2** do not eliminate, reduce, or control affected on-Plant source materials and do not provide for monitoring of soils to ensure that increased releases would be detected; therefore, they may not be adequately protective of human health and the environment for these media.

b) **Soils surrounding the Plant. Alternative 8** protects human health by permanently removing soils surrounding the Plant with constituent concentrations that exceed human health risk-based cleanup goals. **Alternative 4** protects human health by implementing land use and access restrictions to prevent residential exposure to soils with constituent concentrations that exceed human health cleanup goals, and to prevent adjacent property owners from growing food crops for human consumption that are sensitive to cadmium and zinc; therefore, Alternative 4 is fully protective of human health and the environment. **Alternative 5** protects human health by using in-situ biological treatment (accumulating contaminants in crop biomass) to permanently reduce constituent concentrations to below cleanup goals. Reducing constituent concentrations would prevent ingestion of and exposure to (for radionuclides only) solids with constituent concentrations above cleanup goals. Therefore, Alternative 5 is protective of human health and the environment. **Alternatives 1 and 2** do not eliminate, reduce, or control affected soils surrounding the Plant; therefore, they may not be adequately protective of human health and the environment for these media.

c) **Groundwater. Alternatives 4, 5, and 8** assume that past remedial actions, ongoing groundwater pumping, and natural attenuation processes will eventually reduce constituent concentrations to acceptable levels within 30 years. In addition, Alternatives 4, 5, and 8 include land use restrictions to prevent landowners from installing wells for potable use. These provisions would prevent ingestion of affected groundwater until MCLs are achieved, and therefore those alternatives are considered protective. **Alternatives 1 and 2 are not** considered

protective because they do not include controls to ensure that humans are not exposed to contaminated groundwater, and Alternative 1 does not even include a groundwater monitoring program to confirm that constituent concentrations have been reduced to acceptable levels.

2. Compliance with ARARs

a) **Soils, all alternatives:** There are no chemical-specific or location-specific ARARs identified for the off-Plant soils. In the event Alternatives 5 or 8 were selected, there would be action-specific ARARs (i.e., IDAPA 16.01.01.650, Rules for Control of Fugitive Dust) which would have to be (and could be) met by the alternatives.

b) **Groundwater.** Under all alternatives, the groundwater is expected to achieve ARARs, i.e. MCLs, in the long term as past remedial actions, ongoing groundwater pumping, and natural attenuation processes reduce constituent levels below MCLs.

As Alternatives 1 and 2 did not satisfy the threshold criteria, they were not considered further in this evaluation by EPA.

BALANCING CRITERIA:

3. Long-Term Effectiveness and Permanence

a) **On-Plant Source Materials. Alternatives 4, 5, and 8** include monitoring of soils surrounding the Plant and periodic review of Plant compliance with applicable environmental requirements. These alternatives are moderately protective of human health and the environment after the RAOs are achieved.

b) **Soils Surrounding the Plant. Alternative 8** includes excavation and removal of all off-Plant soil with constituent concentrations that exceed human health risk-based TCL-4. Since the reduction in concentrations is permanent, Alternative 8 ranks high in achieving long-term effectiveness and permanence after the RAOs are achieved. **Alternative 5** includes in-situ biological treatment to accumulate contaminants in crop biomass and permanently reduce constituent concentrations to TCL-4 and achieve the human-risk based RAOs for off-Plant soils. The reduction to TCL-4 is estimated to be achieved within 5 years. Since the reduction in concentrations is permanent, Alternative 5 ranks high in achieving long term effectiveness and permanence after the RAOs are achieved. **Alternative 4** includes land use and access restrictions to prevent the ingestion of and/or exposure to soil with constituent concentrations that exceed cleanup goals and to prevent landowners from growing food crops for human consumption that are sensitive to cadmium and zinc; therefore, since human health risks are adequately addressed, Alternative 4 ranks high at providing long

term effectiveness and permanence after the RAOs are achieved.

c) **Groundwater. Alternatives 4, 5, and 8** assume that past remedial actions, ongoing groundwater pumping, and natural attenuation processes will eventually reduce constituent concentrations to acceptable levels. The degree of effectiveness and permanence of these alternatives will be dependent on the successful decrease in constituent concentrations. These alternatives include institutional controls to prevent the ingestion of groundwater until the MCLs are achieved. After the concentrations of contaminants are reduced to below MCLs, the residual risk to human health and the environment would be minimal. Consequently, these alternatives rank high in providing long-term effectiveness and permanence after MCLs are achieved.

4. Reduction in Toxicity, Mobility, or Volume (TMV) Through Treatment

a) **Off-Plant Soils. Alternative 5** would reduce the toxicity, mobility and volume of contaminants in off-Plant Soils by accumulating contaminants in plant biomass (considered a treatment process); therefore, Alternative 5 ranks high in reducing TMV of contaminants through a treatment process. **Alternative 8** was ranked highly in the FS because it would reduce the mobility of contaminants in off-Plant soils by removing all soil with constituent concentrations exceeding human health risk-based TCL-4; however, this is not considered treatment. **Alternative 4** does not include provisions to reduce the TMV of contaminants in soils surrounding the Plant and consequently, they were ranked the lowest.

b) **Groundwater. None of the alternatives** considered include provisions to actively reduce TMV through treatment, since treatment was not considered cost-effective given the contaminant concentrations, aquifer characteristics and success of past remedial actions. Natural attenuation processes are expected to eventually reduce constituent concentrations to below MCLs.

5. Short-Term Effectiveness

a) **Soils Surrounding the Plant. Alternative 8** does not include provisions to protect human health until the soil removal process is complete. Human exposure to contaminants could occur during excavation and material handling. Alternative 8 was ranked low for short-term effectiveness in the FS. **Alternative 5** does not include provisions to protect human health until the in-situ biological treatment process reduces constituent concentrations to acceptable levels and achieves the health-risk based RAOs. Human exposure to contaminants could occur during planting and harvesting activities. Overall, Alternative 5 was ranked low for short-term effectiveness in the FS. **Alternative 4** does not include provisions to protect human health until the institutional controls are in place, but there is unlikely to be short-term risk during construction of residences since the area is agricultural and no residences are likely to be built there in the near future. Risks to the surrounding community are low, since Alternative 4 would not result in mobilizing contaminants during construction. Overall, Alternative 4

ranks moderate to high in providing short-term effectiveness.

b) **Groundwater. Alternatives 4, 5, and 8:** These alternatives would not be protective of human health until the restrictions are in place, if groundwater were used for drinking. Further, they would not be protective of the environment (i.e., groundwater) until the concentrations of contaminants are reduced to concentrations below MCLs. However, since there is no current exposure nor any reason to expect short-term installation of potable wells in the affected area, this approach should be acceptable. No risks are associated with Site workers since construction activities are not required. In summary, these alternatives rank moderate in providing short-term effectiveness for groundwater.

6. Implementability

a) **Soils surrounding the Plant. Alternative 8:** There are no significant technical barriers associated with removing the upper six inches of soils surrounding the Plant, although short-term future crop yield from substituted topsoil could be affected. For this and other reasons, there may be administrative barriers associated with getting the cooperation of off-Plant property owners in allowing excavation of soil on their property. If Monsanto is able to achieve a property buffer around the Site (included in the groundwater remedy), Monsanto could easily control the soil removal process and the administrative barriers would be significantly reduced. Consequently, Alternative 8 is considered moderately difficult to implement. **Alternative 5:** There are no significant technical or administrative barriers associated with the actual planting, harvesting, or disposal of the crops. There may be administrative barriers associated with getting the cooperation of off-Plant property owners in growing appropriate crops. Conducting pilot studies would be moderately difficult to perform and may require a significant amount of time to complete. Consequently, Alternative 5 is considered comparatively difficult to implement. **Alternative 4:** There are no technical barriers that would limit the implementability of Alternative 4, however there could be local landowner resistance to land use and access restrictions. Protracted negotiations could result in a lengthy process, making this alternative moderately difficult to implement.

b) **Groundwater. Alternatives 4, 5, and 8:** A groundwater monitoring program is currently in place at the Site, and modifying the existing program would be easily implemented. Implementing land use and access restrictions would require the cooperation of off-Plant land owners and could be moderately difficult to implement as described above. The implementability of these alternatives for groundwater is considered moderate.

7. Cost

a) **Alternative 8:** 30-year present-value cost to implement is $15,860,000. The total costs of implementing Alternative 8 are considered to be high.

b) **Alternative 5:** 30-year present-value cost to implement is $4,400,000. The total costs of implementing Alternative 5 are considered to be moderate.

c) **Alternative 4:** 30-year present-value cost to implement is $2,570,000. The total costs of implementing Alternative 4 are considered to be moderate.

MODIFYING CRITERIA

8. State Acceptance

The State of Idaho DEQ has participated throughout oversight of this RI/FS and assisted with the development of the proposed plan. The state concurs that Alternatives 1 and 2 would not be protective for this Site. The State's preferred alternative is Alternative 4, Institutional Controls, where such controls can be reliably established. Where such controls cannot reliably be established, as may be the case with some of the off-Plant contaminated soils, the State prefers Alternative 8, active cleanup via excavation. A concurrence letter from the State of Idaho is included with this Record of Decision.

9. Community Acceptance

About 40 people attended the public meeting and/or provided comments during the 60-day public comment period. Most commenters said they viewed residential development in the contaminated soil areas as unlikely, but supported taking some action to prevent unacceptable human exposure. Several adjacent property owners commented that they viewed their property as having been impacted, their property values as having been affected, and supported cleanup over land-use restrictions. Some commenters preferred immediate cleanup, with most of those favoring Alternative 8 rather than Alternative 5, which was viewed as unproven. Some commenters suggested a modified approach to soil cleanup, combining institutional controls with a provision to clean up property if/when land use changes (to residential) were planned.

9. THE SELECTED REMEDY AND RATIONALE

EPA's selected remedy is a combination of elements from 3 alternatives from the FS, as described below. Along with each component of the remedy is the rationale for its selection:

- The **selected remedy for contaminated groundwater is Monitored Natural Attenuation with Institutional Controls** (such as legally enforceable prohibitions on drinking water wells in the affected area) to prevent human exposure to groundwater until it recovers. No further action appears necessary, except monitoring of the groundwater and the Plant discharge outfall, because no one is currently using the contaminated groundwater for drinking and because the combination of past actions and natural attenuation is projected to restore groundwater to levels which allow for unrestricted use and exposure within 30 years. Because groundwater exceeds MCLs, and risk-based concentrations, reviews will be necessary no less often than every five years to ensure that the remedy remains protective, confirm that constituent concentration trends in groundwater and sediments are declining as predicted and eventually to confirm the achievement of MCLs.

- The **selected remedy for source piles and materials within the Plant is No Further Action**, because Monsanto's past cleanup actions, ongoing engineering and Institutional Controls and compliance with federal and state (environmental and worker health and safety) regulations have reduced potential sources of worker exposure and contaminant migration to surrounding soils to acceptable levels under current industrial land use. Five-year reviews will be necessary to evaluate land use, compliance status, engineering and institutional controls (including worker health and safety programs and dust control efforts) to ensure the remedy remains protective, since hazardous substances remain on-Site above levels that allow for unrestricted use.

- The **selected remedy for contaminated soils has multiple components:**

    - For contaminated soils surrounding the Plant which are owned by a named responsible party (to date, only Monsanto has been named), the selected remedy is Institutional Controls in the form of land use restrictions placed in deeds, and enforceable under an anticipated consent decree.
    - For contaminated soils on non-industrial property owned by individuals who have not caused or contributed to the contamination at the Site (agricultural or residential property owners) the selected remedy is an election by each such property owner to have their property either: a) cleaned up via excavation, containment and replacement of contaminated soils, or b) rendered protective of human health and the environment via land use restrictions in the form of an environmental easement to be held by a named responsible party. If contaminated soils are excavated, they will be replaced with clean soil and the contaminated soils will be contained within the Plant and covered with at least 12 inches of clean soil and vegetation (or some other protective cover) to minimize potential human exposure to, or migration of, the contaminated soil.

Until the remedy is completed, unrestricted contaminated areas will be monitored to ensure that

residential development does not occur without appropriate action being taken.

No action is necessary for the City Industrial Park property to the southeast of the Plant, which has historically been and continues to be zoned and used by a cooperating government agency (City of Soda Springs) for industrial purposes, and is expected to remain that way for the foreseeable future.

To ensure that the Selected Remedy can be implemented fairly and in a reasonable timeframe, if residential property owners elect (b) Institutional Controls, they must either:

1) Agree to self impose deed restriction Institutional Controls prohibiting residential use of the affected property until EPA determines such use may be permissible, and enter into a consent decree with EPA to make the Controls enforceable; or

2) Sell either their property or an environmental easement restricting residential development rights for their property to a responsible party (Monsanto), thereby allowing EPA to establish enforceable ICs in its anticipated consent decree with Monsanto. To ensure fair terms for all concerned, such sales will be governed by an independent arbitration process, to be paid for by Monsanto, at which the arbitrator would set a fair selling price which could not be less than the fair market value of the property or easement had the property not been contaminated by Monsanto operations. The arbitration process and arbitrators selected pursuant to the RCRA AOC for SE Idaho slag matters and issued to Monsanto and FMC Corporation in 1996, as described above, will be used.

If for any reason, any residential property owner(s) were to fail or refuse to make any election, i.e., fail to elect either to have their property cleaned up, or to sell it or an environmental easement over it, EPA will evaluate whether alternate cleanup or enforcement actions are necessary.

- EPA's **selected remedy for Air, Surface Water, and Soda Creek sediments is No Further Action**. No action is necessary in these areas because no significant human health concerns or environmental impacts were found related to these media.

While not part of the selected remedy, the selected remedy was developed with the Plant in compliance with pertinent environmental requirements and the assumption that such compliance would continue. If air emissions were to exceed permitted levels, they could pose additional risks to human health or the environment or allow unacceptable levels of contaminants to migrate to surrounding soils at or near the Site which could require CERCLA action.

Future Plant Use

Despite potential risks in excess of the acceptable risk range for future industrial use (assuming EPA default values and no ongoing institutional controls or worker health and safety programs), cleanup alternatives were not developed for alternative future industrial scenarios within the Plant and no remedy has been selected based on such scenarios because Monsanto is considered highly likely to continue to operate the Plant for the foreseeable future. Monsanto has just increased production and

maintains it has the reserves to profitably operate the Plant for over 30 more years.

Cost of the Selected Remedy

The estimated cost of the selected remedy over 30 years is between $2,500,000, if all contaminated soils are addressed through institutional controls at the price estimated in the FS, to as much as $9,500,000, if the full extent of contaminated soils above the remediation goal in potential residential areas is remediated through excavation, soil replacement, and containment within the Plant. The estimated cost of the Soil Institutional Control/ Groundwater Monitoring alternative in the FS was $400,000 for initial capital costs of establishing institutional controls and up to $150,000/year for groundwater monitoring, source/soil monitoring, and dust control, for a 30-year total of up to $2,500,000. Since dust control is required pursuant to the Plant's IDAPA permit and is not part of the selected remedy, that cost is not part of the cost of the remedy. However, the cost estimate still seems reasonable, given that the cost of the arbitration which may be needed was not estimated in the FS.

The FS cost estimate for the active soil cleanup alternative was $16 million dollars, based on cleanup of 435 acres to meet a $1x10^{-4}$ cleanup level. Current estimates of the total area to be addressed at the selected $3x10^{-4}$ cleanup level is 250 acres, of which some 25% are already owned by Monsanto. Thus the maximum cost estimate for the soil remedy over 30 years if all soils outside Monsanto's control require active remediation is an additional $7,000,000, for a total cost estimate of $9,500,000.

Remediation Goals and Points of Compliance:

GROUNDWATER

The selected remediation goals for groundwater are Maximum Contaminant Levels under the Safe Drinking Water Act for cadmium, fluoride, nitrate, and selenium, and risk-based concentrations for manganese (shown below). The points of compliance will include Soda Creek, monitoring wells TW-19, 34, 35, 29, 53, 54, 55, the Harris well, and the three Plant production wells.

Table 6 - MCLs

Constituent	Max Conc.In Groundwater	Conc. at Southern Plant Boundary (mg/L)		Primary MCL(mg/L)
Cd	7.92	0.005		0.005
F	19.93	5.0		4
NO_3	45.0	45.0		44
Se	0.93	0.2		0.05
Mn	1.55	0.015	RBC =	0.18

SOILS

The selected remedy addresses all soils in off-Plant areas containing radionuclides that pose cumulative estimated risks in excess of 3×10^{-4} from residential exposure. At this Site, the $3x10^{-4}$ risk goal corresponds to a radium-226 concentration in soils of 3.7pCi/g and a radiation effective dose equivalent of approximately 15 mrem/year for the radionuclides of concern. To further reduce

cumulative excess risk, in areas where the radionuclide soil cleanup goal is exceeded, the remedy also requires that metals which exceed background and pose an excess carcinogenic risk greater than 10^{-5} (arsenic = 21 ug/l, beryllium = 8 ug/l) or a non-cancer HQ=1 or more (none found) be addressed.

As explained earlier in the RAO section, the FS evaluated a range of potential soil cleanup goals, including $5x10^{-4}$, $1x10^{-4}$ to $1x10^{-6}$, and background. The selected remedy for this Site includes cleanup of soils containing radionuclide concentrations which pose a risk of $3x10^{-4}$ above background for residential land use, including exposure from all potential pathways and media (using EPA's slope factors and risk assessment methodology). The $3x10^{-4}$ risk goal corresponds to a radium-226 soil concentration of 3.7 pCi/g and a radiation effective dose equivalent of approximately 15 mrem/year for the radionuclides of concern at this Site. This goal corresponds to the upper end of the range for cancer risks considered protective at most Superfund sites. EPA may consider risk estimates slightly greater than $1x10^{-4}$ to be protective based on Site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. For this Site, these Site-specific conditions include the high naturally-occurring background concentrations of the radionuclides of concern, the lack of a uniform distribution of the contaminants in soils, current land use, and associated uncertainties.

The $3x10^{-4}$ risk goal for radionuclides is also consistent with levels considered protective in other governmental actions including regulations and guidance developed by EPA in other radiation control programs including: (1) EPA's Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191) which sets a dose limit of 15 mrem/year (equivalent to a risk of $3x10^{-4}$ over 30 years) and (2) EPA's National Emission Standards for Hazardous Air Pollutants (40 CFR 61) which sets a standard for radionuclide emissions from operating elemental phosphorus production facilities, including Monsanto Soda Springs, equivalent to a risk of approximately $3x10^{-4}$.

If owners of contaminated property elect cleanup via excavation, the area to be excavated shall be determined based on the selected remediation goals, using RI/FS results supplemented by additional sampling during remedial design. Excavations shall be perfomed to a minimum depth of 6 inches, followed by confirmation sampling and if necessary additional excavation until cleanup goals are met.

Institutional controls must be established and maintained for all off-plant soil areas in excess of cleanup goals which remain unrestricted and therefore could be developed for residential use **(see Figure 7).**

CERCLA Five-Year Review Requirements

Because this remedy will result in hazardous substances remaining on Site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The following is a partial description of the reviews that will be required by media/area of the Site:

Groundwater:

- Review and assess groundwater and outfall monitoring data (which should be collected and evaluated at least annually);

- Compare groundwater and outfall quality and extent of contamination (plume(s)) to regulatory levels, remediation goals and groundwater modeling projections. Determine if/when remediation goals have been achieved, and if not, that Institutional Controls are still in place and effectively preventing human exposure.

- If groundwater recovery appears to significantly differ from model projections, the model and the need for additional groundwater remedial actions should be re-evaluated.

Soils Surrounding the Plant:

- Soil sampling should be done no less often than every five years to a) determine the concentrations of COCs in soils, and b) verify that source control is effectively preventing further spread of Site contaminants and/or recontamination of soils. Soil sampling should be done from the current fence line out to the phase 2 soil sampling locations, until such time as the Agencies determine that further sampling is not necessary.

- Review that Institutional Controls are in place for all soil grids surrounding the plant which contain radium concentrations greater than the remediation goal of 3.7 pC/g, based on a statistically valid sampling program.

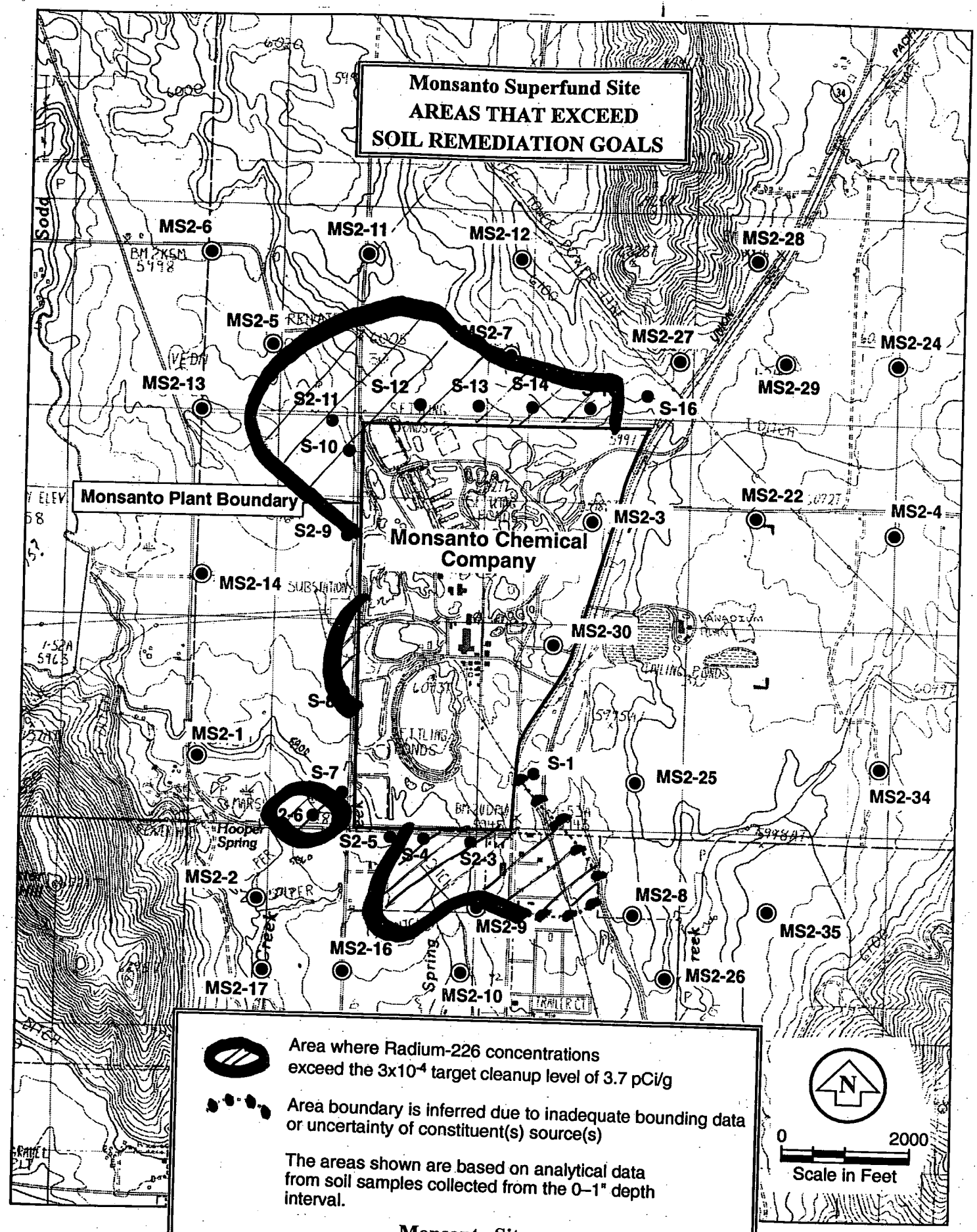
Plant:

- Verify that operations continue to be in compliance with environmental (CAA, IDAPA, CWA, RCRA) and worker health and safety requirements so that potential releases and exposures remain adequately controlled and the remedy remains effective;

- Determine if closure has occurred or is planned, and if so, verify that any required/planned closure procedures are protective;

Sediments:

- Sediment samples should be collected to support the five year review assessment of whether contaminant concentrations are remaining stable or declining as predicted. If sediment concentrations instead are shown to be increasing or evidence of health impacts are identified, the protectiveness of the remedy should be re-evaluated.



Monsanto Site
AREAS THAT EXCEED
SOIL REMEDIATION GOALS
Figure 7

10. STATUTORY DETERMINATIONS

Under CERCLA, EPA's primary responsibility is to ensure remedial actions are undertaken which protect human health, welfare and the environment. In addition, Section 121 of CERCLA, 42 USC 9621, establishes cleanup standards which require that the selected remedial action complies with all ARARs established under Federal and state environmental and facility siting law, unless such requirements are waived by EPA in accordance with established criteria. The selected remedy must also be cost-effective and must utilize permanent solutions, alternative treatment technologies, or resource recovery technologies to the maximum extent practicable. Finally, CERCLA regulations include a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity or mobility of hazardous waste. The following sections discuss how the selected remedy for the Monsanto Site meets these CERCLA requirements.

Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedy is protective of exposure to soils through the implementation of either Institutional Controls or Excavation, replacement and disposal, in combination with soil sampling to verify that sources have been controlled and soils are not further contaminated. The remedy is protective of exposure to groundwater through implementation of Institutional Controls to ensure no human exposure to contaminated groundwater plus a monitoring program to ensure that constituent concentrations decline as predicted.

Compliance with Applicable or Relevant or Appropriate Requirements

The selected remedy will comply with all chemical-specific, action-specific, and location-specific Federal and State requirements that have been identified and which are legally applicable or relevant and appropriate to the remedial action. In addition, other regulations and guidance were considered in the selection of remedy. No waiver of any ARAR is being sought or invoked for any part of the selected remedy.

The ARARs identified for the Monsanto Site include the following:

> **For Groundwater, National Primary Drinking Water Standards (40 C.F.R. Part 141)** are **relevant and appropriate** to the selected remedy. These ARARs will be met by Natural Attenuation and Institutional Controls. The Maximum Contaminant Levels that pertain to the COCs at the Monsanto Site (there are no non-zero MCLGs that pertain) are as follows:

Constituent	Primary MCL(mg/L)
Cd	0.005
F	4.0
NO_3	44.0
Se	0.05

Idaho Ground Water Standards (IDAPA Sec 16.01.02.299). Protects groundwater for beneficial uses, along with **Idaho Antidegradation Policy (IDAPA Sec. 16.01.02.051)**, which requires that existing water uses and water quality be maintained and protected. These ARARs will be met by Natural Attenuation (plus Institutional Controls until cleanup goals are met).

The following **ARARs** pertain in the event active soil remediation is elected or necessary:

Clean Air Act, 42 U.S.C. 7401 et seq., (CAA), National Primary and Secondary Ambient Air Quality Standards, 40 C.F.R. Part 50; CAA National Emissions Standards for Hazardous Air Pollutants, 40 C.F.R. Part 60; CAA New Source Performance Standards, 40 C.F.R. Part 61. The CAA regulations are **applicable** for control of dust particles emitted into the air during remedial excavation activities. In that event, fugitive dust control measures will be required during any excavation and related remedial activities.

Amendment to the NCP, procedures for Planning and Implementing Off-Site Response Actions, 40 C.F.R. 300.440. These rules and requirements are **applicable** to off-site management of CERCLA hazardous substances, pollutants or contaminants resulting from the ROD, in the event active soil remediation is performed and excavated material is taken off-Site (which is not currently planned, but conceivably could occur). In that event, this ARAR will be met by following the Off-site Rules.

Rules for Control of Fugitive Dust, IDAPA 16.01.01.650. This ARAR is relevant and appropriate for the management of fugitive dust in the event active soil remediation is performed. In that event, fugitive dust control measures will be required during excavation and related remedial activities.

Environmental Protection and Health Act, Idaho Code 39-101 to 129. Authorizes rules to protect the environment and human health and safety through state oversight of solid waste disposal and state approval of disposal locations and design. This requirement is relevant and appropriate for the disposal within the Plant of soils excavated from surrounding properties in the event active soil remediation is performed. In that event, the substantive portion of these rules will be addressed in the design of the soil containment area.

The policy, guidance, and regulations which are not ARARs but were nevertheless considered in the selection of the remedy, or which impact the remedy include the following:

Occupational Safety and Health Act (OSHA), 29 U.S.C. 651; the implementing regulations under OSHA, 20 C.F.R. Parts 1910 and 1926. These regulations must be complied with during all remedial activities.

Cost-Effectiveness

EPA has determined that the combination of remedial actions identified in the selected remedy will reduce or eliminate the risks to human health in a cost-effective manner. The costs associated with the selected remedy and cleanup level are significantly less than the cost of active cleanup of all areas. The selected remedy is cost-effective because it provides overall effectiveness proportional to its costs.

Utilization of Permanent Solutions and Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this Site.

Preference for Treatment as a Principal Element

The selected remedy utilizes alternative treatment (or resource recovery) technologies to the maximum extent practicable for this Site. However, because no principal threats remain and treatment of the remaining threats of the Site was not found to be practicable, the selected remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in hazardous substances remaining on-Site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

11. DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy is a logical outgrowth of the preferred alternative in the proposed plan, and it includes the same basic components. In response to comments, however, for soils surrounding the Plant, EPA has elevated excavation and disposal of soils to parity with Institutional Controls, making excavation and disposal an option for affected agricultural and residential landowners who expressed a desire for cleanup, rather than merely a contingency following an effort to establish such Controls. The types of enforceable Institutional Controls that could be used have been developed further than they had been in the FS. The process for implementing purchase of property or easements to establish Institutional Controls has been modified by the addition of the arbitration process to make sure that a fair transaction will occur.

The "Contingency Plan" concept described in the Proposed Plan has been eliminated in favor of the selected remedy because the "Contingency Plan" was seen as too uncertain and likely to encourage property speculation rather than the CERCLA goal of elimination of exposure pathways.

Based on comments and concerns about the feasibility and implementability of in-situ bioremediation at this Site, the selected remedy calls for excavation as the preferred means of soil cleanup, if any such cleanup is required. The Plan had identified bioremediation as the most favorable treatment option. If soil cleanup is required and the responsible parties can demonstrate an effective treatment method that will satisfy the ROD requirements and the affected landowners, this remedy may be reconsidered.

The selected remedy for groundwater is described in this ROD as "Monitored Natural Attenuation with Institutional Controls", rather than "Institutional Controls with No Further Action because past actions plus natural attenuation appears effective" as stated in the Proposed Plan. This modified description does not pose any additional requirements beyond those contemplated in the FS/Proposed Plan, but is more accurate and more consistent with national guidance and other Superfund site decisions.

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RESPONSIVENESS SUMMARY

Section 3 of the

RECORD OF DECISION

Monsanto Chemical Company Superfund Site
Caribou County, Idaho

April 1997

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RESPONSIVENESS SUMMARY

At the Monsanto Site, EPA has met all requirements of CERCLA Section 117 and the NCP for public participation at NPL sites.

In accordance with CERCLA Section 117 requirements, once the RI/FS was complete EPA issued a Proposed Plan, which provided information on the alternatives considered and identified the preferred remedial alternative, for a 30-day public comment period. The start of the comment period was announced in a Public Notice placed in the Caribou County Sun and a fact sheet which was mailed out to the entire mailing list along with the Proposed Plan. Both the Caribou County Sun and the Idaho Statesman ran articles describing the proposed plan and announcing the public comment period. Owners of property adjacent to the Monsanto Plant were sent the Proposed Plan with a cover letter which pointed out that they or their property could be affected by the Proposed Plan, and which urged them to review the plan and to provide comments.

On August 13, 1996, EPA held a Public Meeting to describe the Proposed Plan and take formal public comments. The meeting was transcribed by a court reporter and all comments received are addressed in the Responsiveness Summary.

On August 21, 1996, EPA received a letter from the Mayor of Soda Springs requesting a 30-day extension of the public comment period in order to give the Mayor, local officials and residents more time to review the plan and provide comments. In response, EPA extended the public comment period by 30 days, until September 30, 1996. The Mayor and the City of Soda Springs did not provide further comments.

All comments/questions received at the public meeting and during the 60-day public comment period have been summarized and addressed below.

Monsanto Proposed Plan Public Meeting - Soda Springs Idaho, 8/13/96

Approximately 35-40 people attended the meeting, including about 10 local property owners, reporters from Caribou County Sun & Idaho State journal, Monsanto representatives (Robert Geddes, Kent Lott, Gordon Allend, Pat Hyland, Dale Wilson, Dean Pahl (Montgomery Watson), Wright (MW)), 2 FMC representatives, Gordon Brown of DEQ, and Steve Haness of ATSDR.

Misha Vakoc of EPA moderated the meeting; Bob Geddes and Dean Pahl presented the RI and FS findings & an invitation from Monsanto to give local residents additional information; Tim Brincefield, EPA Project Manager, summarized the results of the Risk Assessment, the preliminary decisions made in scoping the FS, and the Proposed Plan for remedial action. EPA then invited comments and questions from the audience.

Summary of Written Comments/Questions Received and EPA Responses:

Q. **One commenter wrote and supported the proposed plan, but suggested that EPA should give consideration to the suggestion that cleanup only be done if land use changes.**

A. EPA evaluated that option but was unable to identify a reliable, enforceable means of implementing it. That suggestion also would have delayed completion of the remedial action

indefinitely, which is contrary to Agency and public desire to resolve Site issues as expeditiously as possible.

Q. **The City of Soda Springs wrote and asked for an extension of the comment period from 30 to 60 days.**

A. That request was granted, and the comment period lasted until September 30, 1996..

Q. **Several comments were received from local property owners. Those who commented supported action to address the contamination surrounding the Plant, but did not support any future restrictions on use of the surrounding property. Therefore, these commenters recommended implementation of the excavation and on-Plant disposal option.**

A. These comments were considered and the Agency believes the selected remedy addresses those concerns.

Q. **One of the local property owners also suggested that EPA had underestimated risks to farmers farming affected areas, and that risks to farmers would be higher than risks to workers.**

A. EPA did not initially quantitatively estimate risks from farming, rather EPA assumed that farming exposures would be of such an intermittent nature that industrial exposures would be similar or higher, and therefore if the soils are safe for industrial use, they should be safe for farming as well. Subsequently, EPA further evaluated potential carcinogenic and non-cancer risks to agricultural workers laboring near the Monsanto Plant. The conclusion of that evaluation was that excess lifetime cancer risks associated with exposure to radionuclides are similar to the industrial risk estimates and about one third as high in the agricultural worker scenario as in the residential scenario; risks associated with ingestion and inhalation of metals are also similar to the industrial risk estimates and about one fifth as high in the agricultural worker scenario as in the residential scenario. Therefore, EPA believes the selected remedy and remediation goals are protective of agricultural workers.

Q. **One commenter suggested that institutional controls were adequately protective and that there is no need for a contingency remedy. If necessary, cleanup could be undertaken if land use around the Plant ever changed to residential.**

A. See first response on this page.

Q. **One commenter suggested that the contingency remedy for soils should be any form of treatment that would work, not just bioremediation.**

A. EPA would accept substitution of a more-promising treatment alternative for bioremediation if one can be identified. Ultimately, however, treatment was not selected due to the technical uncertainties and community concerns.

Q: **What risks are residents facing? What is the magnitude of the risk and how does it compare to other risks?**

A: EPA assessed potential risks to human health and the environment posed by radionuclides and

metals found at the Site. Risks were evaluated for several possible exposures including, for example, ingestion and inhalation of contaminated soil, ingestion of contaminated ground water, and impacts to Plants and animals. There are no significant risks to workers or residents under current conditions. However, if residences were built in the most contaminated areas near the Plant fence, the potential excess lifetime cancer risks would be unacceptably high ($>1 \times 10^{-3}$); if contaminated groundwater south of (or beneath) the Plant were used for drinking water, risks would also be unaceptably high (no one is currently known to drink the contaminated groundwater).

Superfund law defines an acceptable range of human health risk from hazardous contamination as a 1-in-10,000 to 1-in-1,000,000 lifetime risk of cancer. This means that if a group of 10,000 to 1,000,000 people were exposed to a potential cancer causing situation over a 70 year lifetime, just one additional person would be expected to develop cancer beyond those expected from other causes. Risk above this range from contamination at a Site (i.e., more than a 1 in 10,000 risk of cancer) typically requires some type of cleanup or preventative action.

Note that soils around the Plant are not more contaminated than soils and sources within the Plant; rather, the assumption of residential use (people spend more time there on a given day) results in a higher risk estimate.

Q: **Several commenters asked whether EPA evaluated County zoning/land use ordinances to see if such ordinances were sufficient restrictions on soils to protect against potential exposure.**

A: EPA considered those, however they are subject to change without State or EPA input, and are not enforceable by either. Therefore, EPA guidance recommends the use of enforceable easements or covenants as Institutional Controls. At many sites deed restrictions or other means have typically been used. Local ordinances are being relied on at the Bunker Hill Site in Northern Idaho, but the costs and administrative burden of the process established there to deal with the many affected properties in the Silver Valley appear high relative to the circumstances at the Monsanto Site.

Q: **EPA was asked whether EPA considered only taking/requiring action if development actually were to take place, instead of doing so immediately.**

A: EPA considered that, and it would be possible, but as discussed above, it could delay completion of the remedial action indefinitely and otherwise be difficult to enforce, thus it was not selected. At most sites where cleanup has been put off until or unless the land is disturbed/developed (other than Bunker Hill), EPA has still required that there be some form of deed restriction in addition to the local ordinance. In this case, such a notice might describe or show the affected area(s) and state that they must be remediated if/when developed for residential purposes. To make this work, we would need to identify someone (at Bunker Hill, the local Health Department) to be responsible for overseeing the process and someone (likely Monsanto) to pay for the work.

Q: **Some asked whether EPA could or would compel landowners to clean up their land.**

A: That question does not have a single, simple answer. Under the law, owners of contaminated property may be potentially responsible for the cost of investigation and cleanup of Superfund sites. That provision was designed to "make polluters pay"; therefore, under the law, adjacent

property owners could be potentially responsible parties. However, EPA has some discretion and looks at the facts in each and every case. In this case EPA has only named one potentially responsible party (Monsanto) to date, since they are apparently the sole source of the contamination. EPA has no information at this time to support naming additional potentially responsible parties. EPA does hope that property owners will do what they can to help make the selected action happen, such as providing access for cleanup to occur or agreeing to sell the property development rights to Monsanto, who in turn would preclude any residential development of the affected area(s).

Q: **One questioner asked whether EPA could condemn affected property or compel owners to restrict/clean up their property.**

A: Under certain circumstances, EPA could issue a unilateral Administrative Order to compel a landowner to allow EPA access to perform actions necessary to protect human health or the environment. At this Site, since owners have been given a choice between Institutional Controls and excavation, EPA does not anticipate having to compel anyone to comply.

Q. **EPA was asked what it thought was "reasonable time frame" it was considering for the soils contingency described in the Proposed Plan.**

A: EPA had been thinking in terms of about 1 year from the date the ROD is completed, however EPA deliberately left the time frame out of the proposed remedy in order to retain some discretion to adjust to changing circumstances that might affect the time to complete Institutional Controls. Ultimately, EPA's selected remedy gives property owners six months to elect excavation or Institutional Controls.

Appendix A

Additional Figures and Tables

RECORD OF DECISION
for the
Monsanto Chemical Company Superfund Site
Caribou County, Idaho

April 1997

Table A-1
Identification of Chemicals of Potential Concern in Ground Water

Analyte	Maximum Concentration[a]	Maximum Background Concentration[b]	MCL	MCLG	Human Health RBC[c]
	(mg/L)				
Aluminum[e]	0.158	0.152	0.05[d]	0.05[d]	3.6E+00
Arsenic	0.0016	0.002	0.05		1.1E-03
Beryllium	ND	ND	0.004	0.004	1.8E-02
Cadmium	0.0042	ND	0.005	0.005	1.8E-03
Calcium	235	178	--	--	--
Chloride	166	22	250[d]	--	3.1E+03
Chromium (total)	NE				
Copper	NE				
Fluoride	5.5	0.25	4	4	2.2E-01
Iron	0.594	0.165	--	--	--
Lead	NE				
Magnesium	133	106	---	--	--
Manganese	0.05	0.010	---	--	1.8E-02
Molybdenum	0.126	ND	---	--	1.8E-02
Nickel	0.01	ND			7.3E-02
Nitrate as N	12.2	1.44	10	10	5.8E+00
Potassium	16	5.85	--	--	--
Selenium	0.472	0.0075	0.05	0.05	1.8E-02
Silver	NE				
Sulfate Ion	478	110	250[d]	500[f]	--
Vanadium	0.018	0.014	--	--	2.6E-02
Zinc	0.216	0.011	5[d]	--	7.3E-01
RADIONUCLIDES	(pCi/g)				
Radium-226+D	NE				
Radium-228+D	NE				
Radon-222	NE				
Uranium-238+D	NE				

Shading indicates maximum detected concentration exceeds column values; shading in the Analyte column indicates a COPC.

a = Ground water wells evaluated include: Harris, Lewis, TW-53,54,55. These wells would represent ground water potentially available in a future residential scenario.

b = Based on Wells TW-57, TW-29, TW-15 from November 1992 and May 1993 sampling records.

c = RBC based on residential default exposure parameters.

d = Secondary MCL

e = Aluminum is not retained because SMCL is below background, and max is less than RBC

f = Proposed

ND = Not detected

NE = Not evaluated; dropped as a COPC during Phase I or early Phase II risk screening analysis.

Table A-2
Identification of Chemicals of Potential Concern in Soil

Analyte	Maximum Concentrations	Background		Noncancer RBCs[b] HQ=0.1	Carcinogenic RBCs[b] Risk = 1E-07
		Maximum	UTL[a]		
	(mg/kg)				
Aluminum	30200[h]	16,500	19,187	27,000	--
Arsenic	34.0	5.4	6.1	8.2	3.7E-02
Beryllium	4.0	1.7	2.7		1.5E-02
Cadmium	168	9.7	9.3	27	--
Chromium Total	325	21.0	23.3	27,000[g]	--
Copper	42	19.6	23.1	1,000	--
Fluoride[c]	136.0	6.1	4.9[h]	1,600	--
Iron	55,500	23,000	NC	--	--
Lead	68	81	NC	--	--
Manganese	1380	696	807	3,800	--
Molybdenum	2.9	1.7	1.6	140	
Nickel	87.3	53	NC	550	--
Nitrate as N	47	13	NC	44,000	--
Selenium[d]	109	0.4	NC	140	--
Silver	13.0	1	NC	140	--
Uranium[e]	5.3	0.5	NC	90	
Vanadium	467	42	36.0	190	--
Zinc	2,670	123	112.6	8,200	--
RADIONUCLIDES	(pCi/g)				
Lead-210+D	65	3.2	4.0		1.2E-01
Polonium-210[f]	77	3.6	3.7		5.3E-01
Potassium-40	19	20	NC		7.7E-03
Radium-226+D	17	2.7	2.9		6.9E-04
Radium-228+D	1.4	1.7	NC		1.4E-03
Thorium-228+D	1.6	1.6	1.7		7.4E-04
Thorium-230	18	2.1	2.1		5.7E+00
Thorium-232	1.6	1.7	NC		6.4E+00
Uranium-238+D	16	1.4	2.4		8.0E-02

Shading indicates maximum detected concentration exceeds column values; shading in the Analyte column indicates a COPC.

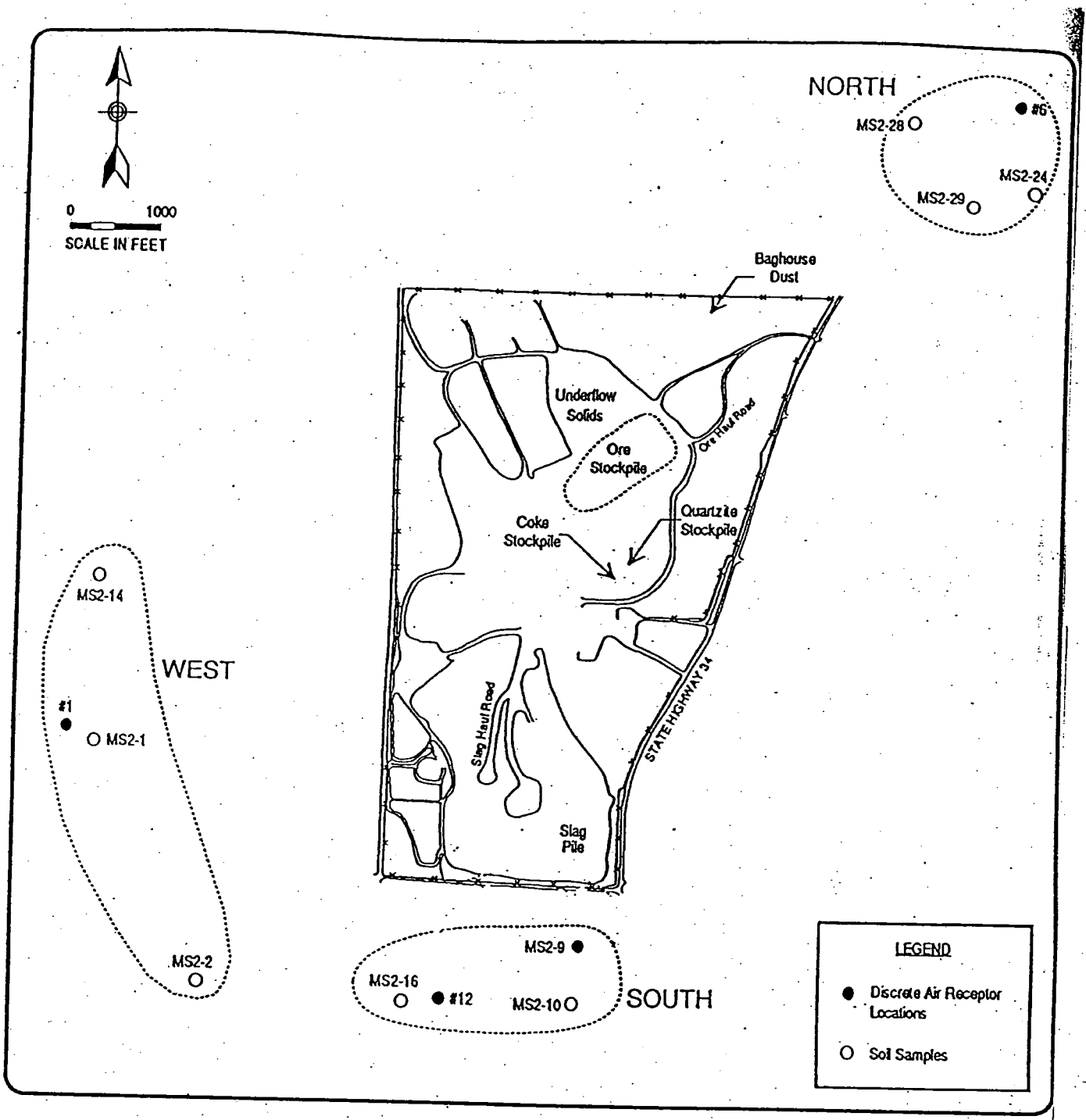
a = Log normal conversion before UTL calculation.
b = Based on residential default exposure parameters.
c = Site Fluoride concentrations based on soluble fraction only.
d = Limited data set.
e = Uranium concentration converted from measured activity of U-238 by multiplying by 0.331.
f = Polonium-210 not retained because it is considered in lead-210+D chain.
g = Chromium III RBC
h = Outlier thrown out before treatment of data set
NC = Not calculated.

Table A-3
Identification of Chemicals of Potential Concern in Source Materials

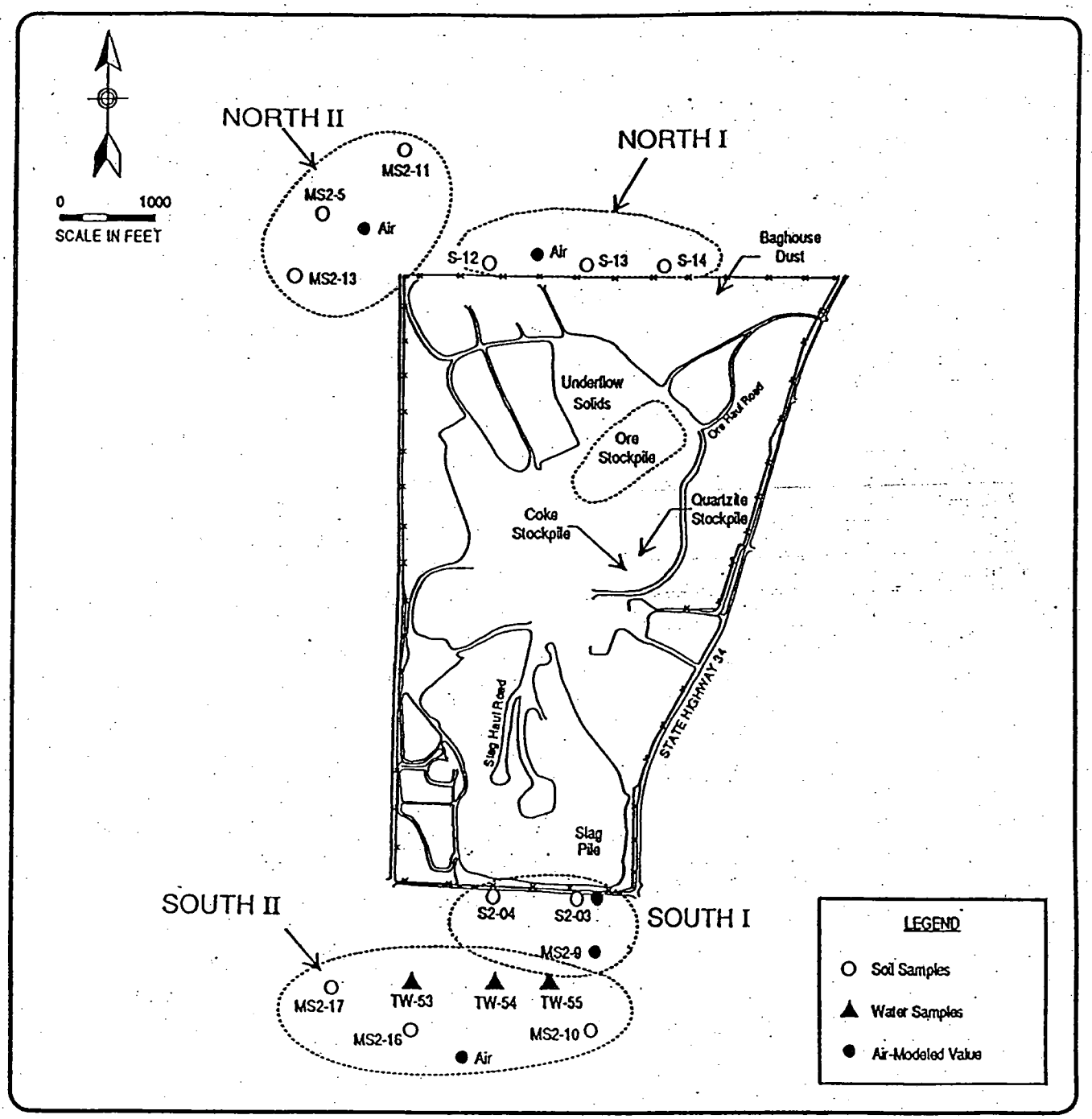
Analyte	Maximum Concentrations	Background Concentration		Noncancer RBCs[g] HQ=0.1	Carcinogenic RBCs[g] Risk=1E-07
		Maximum	UTL[a]		
	(mg/kg)				
Aluminum	27,700	16,500	19,187	200,000	--
Arsenic	500	5.4	6.1	61	3.3E-01
Beryllium	60.1	1.7	2.7	1,000	1.3E-01
Cadmium	2,070	9.7	9.3	100	--
Chromium (Total)	30,500	21.0	23.3	200,000[b]	--
Copper	86.9	19.6	23.1	7,600	--
Fluoride[c]	14,500	66.1	11.6	12,000	--
Iron	12,200	23,000	NC	--	--
Lead	200	81	NC	--	--
Manganese	899	696	807	29,000	--
Molybdenum	893	1.7	1.6	1,000	
Nickel	170	53	NC	4,100	--
Nitrate as N	79	13	NC	330,000	--
Selenium[d]	231	0.4	NC	1,000	--
Silver	94	1	NC	1,000	--
Uranium[e]	15.6	0.5	NC	6700	--
Vanadium	65,100	42	36.0	1,400	--
Zinc	54,200	123	112.6	61,000	--
RADIONUCLIDES	(pCi/g)				
Lead-210+D	390	3.2	4.0	--	4.9E-01
Polonium-210[f]	260	3.8	3.7	--	2.1E+00
Potassium-40	11	20	(NC)	--	4.0E-02
Radium-226+D	54	2.7	2.9	--	3.6E-03
Radium-228+D	1.0	1.7	(NC)	--	7.5E-03
Thorium-228+D	0.9	1.6	1.7	--	3.9E-03
Thorium-230	430	2.1	2.1	--	2.3E+01
Thorium-232	4.8	1.7	(NC)	--	2.6E+01
Uranium-238+D	48	1.4	2.4	--	4.2E-01

Shading indicates maximum detected concentration exceeds column values; shading in the Analyte column indicates a COPC.

a = Log normal conversion before UTL calculations.
b = Chromium III RBC
c = Site Fluoride concentrations based on soluble fraction only.
d = Selenium date may be unreliable, awaiting further sample results.
e = Uranium concentration converted from measured activity of U-238 by multiplying by 0.331.
f = Polonium-210 not retained because it is considered in lead-210+D chain.
g = Risk-based concentrations are based on the industrial scenario default exposure factors
NC = UTL not calculated



ENVIRONMENTAL SAMPLES USED IN CURRENT RESIDENTIAL SCENARIOS



ENVIRONMENTAL SAMPLES USED IN FUTURE RESIDENTIAL SCENARIOS

Appendix B

Administrative Record Index

RECORD OF DECISION
for the
Monsanto Chemical Company Superfund Site
Caribou County, Idaho

April 1997